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of Engineers**

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June 1996**

# **An Evaluation of Scheduling Requirements on Federal Fixed-Price Construction Projects**

by  
E. William East and Clifford Weese

Thirty-two agencies have jurisdiction over Federally funded construction projects. Variation among agency requirements for project planning and scheduling has been thought by members of the construction industry to be a barrier for small and medium sized contractors who wish to bid on Federal construction projects. Regulatory variation was also thought to raise the cost of Federal construction projects.

The results of an evaluation of Federal scheduling specifications and follow-up survey of Federal agencies participating in the Federal Facilities Council's Project Management Committee indicate that general scheduling requirements are similar across all agencies. Agencies appear to limit the use of complex scheduling and planning methods to larger projects. The low cost bar charting technique is consistently used on construction contracts under \$1 million. For smaller projects, and projects that do not fit well into traditional scheduling methods, few offices cited the use of the fenced-bar chart or line-of-balance techniques.

For projects, over \$1 million, virtually all offices used commercial Critical Path Method scheduling software. A significant number of survey respondents, however, appeared not to address many scheduling issues that affect the usefulness of the scheduling system output. Survey respondents also pointed to another troubling issue—proprietary requirements for scheduling software.

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## Foreword

This study was conducted for the U.S. Army Corps of Engineers (HQUSACE) under Military Interdepartmental Purchase Request E85960046 dated 22 January 1996. The technical monitor for this project was Stan Green, CEMP-CE. The co-technical monitor for this report was William Vogel, CEMP-M.

The work was performed by the Engineering Processes Division (PL-E) of the Planning and Management Laboratory (PL), U.S. Army Construction Engineering Research Laboratories (USACERL). The USACERL principal investigator was E. William East. Dr. Michael P. Case is Chief, CECER-PL-E; L. Michael Golish is Operations Chief, CECER-PL; and Dr. David M. Joncich is Chief, CECER-PL. The USACERL technical editor was Linda L. Wheatley, Technical Information Team.

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COL James T. Scott is Commander and Acting Director, and Dr. Michael J. O'Connor is Technical Director of USACERL.

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# 1 Introduction

## Background

Project planning and scheduling techniques are required for all Federal construction projects by Federal Acquisition Regulation (FAR). One section of this regulation instructs Federal agencies on using project planning techniques to ensure that taxpayer interests are protected during a construction project. Based on the broad requirements of the FAR, each agency prepares internal regulations and standing operating procedures that ultimately appear in construction contracts.

Thirty-two agencies have jurisdiction over Federally funded construction projects. Variation among agency requirements for project planning and scheduling has been thought to be a barrier for small and medium sized contractors who wish to bid on Federal construction projects. In addition to being a barrier to entry for unfamiliar contractors, the regulatory variation was also thought to raise the cost of Federal construction projects.

The Federal Facilities Council (FFC), which sponsored this project, is a cooperative association of 18 Federal agencies with interests and responsibilities related to Federal construction. The FFC's mission is to identify and advance technologies, processes, and management practices that improve the planning, design, construction, maintenance, management, operation, and evaluation of Federal facilities.

The FFC operates under the auspices of the Board on Infrastructure and the Constructed Environment (BICE), which is a unit of the Commission on Engineering and Technical Systems (CETS) of the National Research Council (NRC). A Program Committee plans and coordinates FFC activities. To help fulfill the FFC's mission, the Program Committee has established six standing committees. The specific committee under which this project was conducted is the Standing Committee on Project Management, which addresses technical, administrative, and policy issues associated with the management of design and construction contracts for Federal facilities.

## **Objectives**

In July 1994, the FFC Standing Committee on Project Management began discussing ways to improve the timeliness of Federal construction projects while reducing the administrative burden imposed on construction contractors. In addition to the timeliness of construction projects, consideration was given to: (1) the development of a consistent set of requirements to simplify Federal contracting, (2) the impact of reductions in government personnel to monitor progress schedules, and (3) the need to identify the benefits of formalized project planning. Based on these discussions, a study was undertaken to evaluate the effective use of construction planning across all Federal agencies participating in the FFC. The objective of the study, then, was to evaluate the specification and use of project scheduling on Federal construction projects.

## **Approach**

The first part of the study was a comparative review of the contract clauses used for scheduling Federal construction projects (Appendix A). The second part was a survey to identify how those clauses were actually used to determine the current state of project planning and scheduling across the Federal government (Appendix B).

## **Scope**

The conclusions and recommendations included in this report are based on review of Federal scheduling specifications. All agency representatives, acknowledged in the Foreword, had the opportunity to review the conclusions and recommendations. All comments provided have been included in this report.

## **Mode Of Technology Transfer**

The results of this report may be used by construction project owners or owners representatives at all levels of government and private practice to reduce the cost of construction through revised and improved project scheduling practice. Construction contractors and consulting firms may use this report to review general agency requirements and rationale for scheduling.

The results of this report also may be used by Federal, state, and local government agency representatives to develop more effective scheduling specifications. The report

also may be published by the National Research Council, National Academy of Sciences. Copies will be provided to U.S. state governors.

## 2 Federal Acquisition Regulation

All Federal agencies use the FAR or other supplemental regulations to acquire supplies and services. FAR clause 58.236-15, "Schedules for Construction Contracts" (1984) specifically relates to the scheduling of construction contracts. Federal construction agencies may reference this clause (provided below) or use an appropriate agency supplemental clause.

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

Each agency may interpret the FAR clause to best fit their specific needs for project scheduling. Because the FAR was written more than 10 years ago, many areas of the regulation need to be expanded upon to fully address current issues. The interpretation of the FAR clause, by each responding agency, is discussed in the next chapter.

### 3 Evaluation of Scheduling Specifications

Construction scheduling specifications from 11 Federal agencies were submitted by committee members. The complete set of collated specifications sections are provided in Appendix A. A complete index of these specifications is provided at the end of the appendix. The following paragraphs discuss the requirements for specific data in the scheduling specification, describe the contents of the collated specification sections, and identify any significant deviations between agencies.

#### Introductory Sections

The primary purpose of the introductory sections of scheduling specifications is to provide information to specification writers. Information included in the instructions section (see Appendix A, General) should assist specification writers to determine the type of schedule required.

For smaller projects, bar charts are the preferred scheduling method. Large, complex projects require the evaluation of the duration of tasks and the sequence between the tasks. Therefore, the Critical Path Method (CPM) is specified.

Table 1 compares agency thresholds for bar charts with CPM for those agencies that publish their instructions as part of their guide specifications.\* The General Services Administration (GSA) has the most detailed requirements distinguishing between bar charts, simple CPM schedules, and detailed CPM schedules. Thresholds for the Voice of America (VOA) (a branch of the U.S. Information Agency), the Department of Veterans' Affairs (DVA), and the Corps of Engineers (COE) set \$1 million as the level at which CPM schedules are required. The DVA and the COE also require contractors to submit their construction schedules on a data disk. Specifications and regulations for agencies not included in Table 1 do not identify dollar thresholds but mention that complex projects or time-sensitive projects should be scheduled using CPM.

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\* Other responding agencies may have instructions similar to those provided in Table 1; however, that information was not included as part of the specification submission.

**Table 1. Matrix of schedule types.**

<b>Project Size (\$)</b>	<b>Contract Type</b>	<b>Payment Type</b>	<b>Schedule Type</b>	<b>Agency</b>
< 2.5 M	Traditional	Fixed-Price	Bar Chart	GSA
2.5M - 5M	Traditional	Fixed-Price	Simple CPM	GSA
> 5M	Traditional	Fixed-Price	Detailed CPM	GSA
>1M	RFP, IFP, other	any	CPM	VOA
>1M	any	any	Data Disk - VA Format	DVA
>1M	any	any	Data Disk - SDEF	COE

In addition to providing information for specification writers, introductory scheduling specification sections also explain the purpose or importance of the contractor's timely completion of the project to the project's overall success. The specification submitted from the Department of Health and Human Services (HHS), National Institutes of Health (NIH) provides one example of such a purpose statement:

It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the work are of the essence of this Contract. The work shall be executed with such progress as required to prevent any delay to other contractors working on other projects at the site, the Contract milestone dates, and the general completion of the Contract.

Many general contractors hire consultants to produce construction schedules, so the initial statement of purpose in the scheduling specification is vital. Even if the prime contractor does not care to understand the details of the CPM, the importance of timely completion is emphasized as the reason for a schedule's creation and use. VOA's purpose statement, excerpted below, clearly describes the schedule's use:

... the effective planning, scheduling, cost accounting, and reporting of the design, fabrication, shipment, installation, commissioning, and acceptance testing ... (The schedule) shall be used by the Contractor to generate monthly management reports which will provide the following: A measurement of actual performance versus targeted schedules; A basis for assessing requests for progress payments; An early warning system for forecasting potential problem areas; ...

### ***Qualifications for Contractors' Staff***

Introductory sections of construction contracts for many agencies also require that persons who produce the construction schedule be qualified to do so. Typical requirements for the project scheduling staff run from the use of in-house resources to use of a construction scheduling consultant (see Appendix A, Personnel Qualifications).



While the use of scheduling consultants may eliminate the need to train contractor personnel in the use of correct CPM scheduling, schedule consultants often do not coordinate their project plans adequately with the contractor and subcontractors working on the project. Specifications often do not directly address this issue but require the contractor to produce a reasonable plan of construction and allow the Government to approve the scheduling consultant to be used.

### ***The Schedule Is Used for Payment***

While contractors are primarily concerned with the estimated and actual cost of construction, on fixed-priced contracts, the Government is primarily concerned with the agreed upon and budgeted Earned Value of each activity. Adding the budgeted and actual Earned Value to each schedule activity is required at most agencies (see Appendix A, Basis for Payment).

Adding the budgeted Earned Value of each activity allows the schedule to be updated with the actual Earned Value for each activity as the project proceeds. Adding the Earned Value of all the completed and in-progress activities provides the total value of the work that has been accomplished.

Federal scheduling specifications frequently describe adding Earned Value as "cost-loading." From the Federal agency's view, the Earned Value is the cost of the activity; however, to the contractor who must track budgeted and actual costs over time as well as Earned Value, the specifications may not provide sufficient explanation. Persons not specializing in construction scheduling might find it difficult to match the cost-loading requirements of the Federal agency specifications with the variety of cost fields available to contractors in many commercial software systems. Training of government scheduling personnel and specification writers should be provided to fully explain the differences between the various types of cost loading that may be included on schedules.

Deductions from the total amount earned may be withheld according to the scheduling specifications of some of the participating agencies. The specifications describe the conditions under which payment will be withheld.

## **How To Schedule the Project**

Sections describing how the schedule is to be calculated frequently appear in Federal scheduling specifications. Once the size of the project exceeds the threshold for bar charts, CPM is specified by all Federal scheduling specifications (see Appendix A, Use

of the Critical Path Method). The use of CPM on a specific project demands that the contractor divide a project into a set of tasks. Since construction work is sometime process and not task oriented, the level of approximation that needs to be incorporated into the schedule is also addressed (see Appendix A, Level of Detail Required).

Knowing the correct method and level of project detail should be enough to properly create a project schedule; however, several items can change the schedule result, often without the knowledge of anyone but the project scheduler. These items, described below, are often incorporated into commercial software systems as "time-saving" devices for the project scheduler. These devices are actually ways for the scheduler to be less than precise about the sequence of a schedule or the progress being made.

A type of bar chart addressed in Federal scheduling specifications is the fenced-bar chart, which adds lines (referred to as fences) between activity bars to show the sequence between tasks. With the fenced-bar charts, the impact of changes or delays to a project may be evaluated. Training is recommended for Federal schedulers on the specification and use of fenced-bar charts.

### ***Critical Path Method***

While more complicated than the standard bar chart technique, CPM allows users to see how changes to specific activities impact the overall project. CPM is able to show the expected impact because both sequence and duration are represented in the project plan. The bar chart technique does not explicitly give any information about the sequence between tasks.

CPM has two versions: the arrow diagram and the precedence diagram methods. Each method has its advantages and disadvantages, and few Federal agencies specify the use of a single technique. Contractor's are often more familiar with the precedence diagram method, so it is important for Federal specifications to allow the use of this type of network.

While the CPM method is widely used, some aspects of CPM are difficult for many people to use. Graphical techniques for the scheduling of repetitive horizontal and vertical projects may, ultimately, prove to be more successful. The most useful of these graphical techniques is the line-of-balance (LOB) method. It is recommended that information regarding the LOB be provided to construction contractors and Federal specification writers and schedulers.

### ***Level of Detail***

The amount of information contained in a CPM schedule greatly depends on the type of project and the knowledge of the scheduler. People creating schedules typically include a disproportionately large number of activities to those types of tasks with which they are familiar. For example, a civil engineer creating a schedule will tend to add many site work and structural activities and may virtually ignore mechanical and electrical activities.

While a small number of activities reduces the administrative effort required to maintain the schedule, a balance can be struck between reduction in administrative effort and the accuracy of the schedule. One rule of thumb that may be used is that the duration of any activity that has an earned value should be shorter than the payment period. For example, if the contractor is to be paid every 30 calendar days, then construction tasks should be less than 20 working days (30 calendar days) in length. Keeping the length of activities shorter than the length of the payment period means that, in general, activities will not extend over two payment periods. When activities stretch over several payment periods, the government and contractor's representatives may have difficulty agreeing on the actual Earned Value for each activity.

The primary method used to evaluate the accuracy of the schedule is to separate the project into groups of similar activities and compare the tasks. Computerized CPM scheduling systems allow users to quickly sort and select activities. Activity "codes" are used to differentiate between sets of activities. Different project requirements have different sets of activities to evaluate (see Appendix A, Level of Detail Required).

The activity coding information required of contractors under Federal specifications appears to fall into several categories:

- Work flow information (i.e., Workers Per Day, Work Area, Trade (also called responsibility) and Feature of Work (work breakdown structure) allow activities to be created that correctly model the way the contractor will perform the work.
- Procurement activities, government tasks, and Category Codes allow external factors that frequently delay projects to be included in the project plan.
- Payment related information such as Bid Item Code and Mod or Claim Code are included to ensure that contractors accurately allocate the project current or future Earned Value across all schedule activities.

The method that the contractor uses to identify specific groups of activities is to be submitted for approval (see Appendix A, Standard Activity Coding Dictionary).

### ***Negative Lags***

The typical sequence considered when building an arrow diagram is that one activity is completed before the start of the following activity. This type of sequence, often referred to as a "conventional sequence," extends from the finish of one activity to the start of the following activity. In the precedence diagram, the conventional sequence is supported and the start-to-start and finish-to-finish sequence is added. The two additional sequence types in the precedence method allow appropriate activities to be modeled as concurrent tasks. Durations may also be associated with sequence in the precedence diagramming to model the familiar notion that one task could only start a number of days after the start of the prior activity.

The duration on the start-to-start sequence is properly called a "lead" time. The duration on a finish-to-finish sequence is properly called a "lag" time. Commercial software systems often name lead and lag times incorrectly, referring to both lead and lag times as lag.

"Negative lag" occurs when a duration of less than zero is applied to any type of sequence in a precedence diagram. The impact of this nonstandard precedence scheduling on the schedule calculations is similar to that of a start-to-start sequence with a positive lead duration. Because the technique is nonstandard, some agencies specifically disallow the use of the negative lag (see Appendix A, Negative Lag).

### ***Default Progress Calculations***

Many commercial software systems have incorporated another item that allows schedulers to automatically update schedules. This feature is used most often when a scheduling consultant has not properly coordinated work on site with the progress schedule. To correctly measure progress, four pieces of information must be gathered on every activity: Actual Start Date, Remaining Duration, Earned Value to Date (or percent complete based on cost only), and Actual Finish Date. Many agencies correctly restrict the use of computer algorithms that may be used to determine actual start dates or Earned Values based on a partial set of activity progress data (see Appendix A, Default Progress Disallowed).

### ***Out-of-Sequence Progress***

Because a project schedule is only an approximate model of a construction project, and changes to the initial plan will virtually always occur as a project progresses, some activities may progress in violation of the sequence shown in the schedule. For

example, one activity is to follow a second activity and the second activity starts before the first activity has been completed.

While out-of-sequence progress may pose some difficulty in correctly evaluating contract completion, most software systems correctly schedule a project that contains out-of-sequence activities. Because difficulties sometimes occur with out-of-sequence progress when activities span more than one payment period, one agency requests contractors notify the appropriate representative when out-of-sequence progress occurs (see Appendix A, Out-of-Sequence Progress).

## **How To Start and End the Schedule**

Starting the job on time, completing project phases before they are due, and completing the overall job within the contract period are some of the ingredients of a successful project. Specifications require inclusion of project milestones in schedules to ensure that the dates calculated by the software correctly reflect overall contractual requirements.

### ***Project Start Date***

Schedulers may use one of several data fields in a software system to fix the start of a project. One agency specifically defines which data field is to be used to fix the start of a project so that data disks exchanged between the contractor and agency representatives will produce the same result regardless of scheduling system used (see Appendix A, Project Start Date).

### ***Project End Date***

Schedulers may use one of several data fields in a software system to fix the end of a project. Fixing the end date is important so, if a project falls behind schedule, those activities that are delaying the project will have a negative total float. One agency specifically defines which data field is to be used to fix the start of a project so that data disks exchanged between the Contractor and agency representatives will produce the same result regardless of scheduling system used (see Appendix A, Constraint of Last Activity).

### ***Intermediate Project Milestones***

Many projects have multiple phases, each with contractually required completion dates, so one agency requires that interim start and finish dates be included in the

schedule. Using these fixed dates, the progress of each phase of work may be correctly evaluated (see Appendix A, Interim Completion Dates).

### ***Early Project Completion***

Specifications are surprisingly silent regarding a contractor's possible plans to complete a project before the contract completion date. Some agencies appear to force contractors to show the contract completion as their finish date or simply ignore the issue (see Appendix A, Constraint of Last Activity). This issue, however, may not need to be addressed directly by specifications provided that agencies allow the contractor to include an early project completion milestone.

## **When To Submit the Schedule**

Because the bar chart or CPM schedule should coordinate contractor and subcontract resources and then track the project's progress from start to finish, specifications typically instruct the contractor as to when and what type of schedule to submit at different points in the project. The submission and updating of reasonable schedules is vital to any evaluation of progress and possible later claims, so receiving the correct data from the contractor is essential to protect taxpayer interests.

### ***Preliminary Schedule***

For larger projects, the submission of the contractor's plan for the first 60- or 90-day effort is vital. This preliminary plan tells the agency representatives and subcontractors what major actions will be required of them so they may assist the contractor to begin the project expeditiously. Activities containing budgeted Earned Value items may be included in these schedules to reimburse the contractor for some mobilization activities such as the Performance Bond and Insurances (see Appendix A, Preliminary Project Schedule Submission).

### ***Initial Schedule***

The initial schedule submission is the contractor's plan for completing the work, on or before the contract completion and interim milestone dates. In addition to outlining the contractor's activities, items of coordination with agency or user organizations, Architect/Engineer (A/E) firms, and subcontracting activities should be included (see Appendix A, Initial Project Schedule Submission). For purposes of prompt payment, evaluation of changes to the contract, and later potential litigation, it is vital that the

preliminary project plan be reasonable and that the contractor execute the work based on the tasks described by the plan.

### ***Progress Updates***

Periodic schedule updates provide the basis for measuring the contractor's progress, earnings, and ability to complete the project on or before the contract completion and interim milestone dates (see Appendix A, Periodic Schedule Updates). To maintain the accuracy of the schedule, changes should be made to reflect differences between the initial plan and the work that is ongoing. The precedence of out-of-sequence tasks may need to be changed. All approved change orders should be included in the schedule to reflect the current scope of work and revised project completion or interim milestone dates.

### ***Progress Meetings***

Progress meetings are held to ensure that the contractor has the opportunity to discuss outstanding issues affecting the completion of the project. The meeting is an opportunity for all project partners to clearly express their concerns in the context of impacts of decisions or delays on individual (or groups) of schedule activities (see Appendix A, Periodic Progress Meeting and Periodic Progress Meeting Contents).

## **How To Submit the Schedule**

This section discusses the format of the information that is to be provided at the times specified by contract.

### ***Printed Reports***

Printed reports listing all activities, calculated and actual start and finish dates, and total float are typically a staple of project managers. While these reports are required by the majority of responding agencies (see Appendix A, Schedule Reports), transmission of the schedule in electronic form should limit the amount of paper that needs to be printed. A package of reports may result in printing and reproduction of several hundred pages of paper each month. Agencies should consider providing direction to reduce the paper reports required of contractors.

One report that was not included in most specifications is a report that lists, even in a bar-chart format, the tasks that should start and finish during the next payment period. Often this type of report is the most useful of all.

### ***Network Diagrams***

Network diagrams are large plotted pictures of the sequence between activities. The diagrams may be time-scaled or simply may provide the sequence between tasks. The diagrams are required by many agencies, particularly at the start of a project (see Appendix A, Network Diagrams). Because of the difficulty in obtaining meaningful diagrams, many agencies include specific instructions on how to manipulate computer software to produce readable drawings. Producing these diagrams is quite expensive and a main reason why contractors turn to consultants to produce schedules.

### ***Narrative Reports***

The narrative report is an essential part of the schedule update process (see Appendix A, Narrative Report). In the narrative report, the contractor documents the progress made and problems encountered during an update period. It is essential that this information be obtained and properly maintained during construction. Determining the impacts of change orders or claims following project completion will require correctly updated schedules. Without the narrative report, the only way for the schedule to be validated is through a painstaking reconstruction of the project from daily reports.

Contractors who are required to produce these narratives also benefit from written statements of problem areas because a record of problems will be available for reference. These records allow a rapid settlement of valid claims because the negotiations will focus on the impacts of the documented claims rather than confirming that impacts actually occurred.

### ***Data Disks***

The exchange of electronic versions of schedules is the most efficient and least costly method for transmission of the schedule from the prime contractor to all other project partners. While all offices using computerized CPM scheduling could support some form of electronic exchange, most Federal offices do not specify the electronic exchange of project planning data. Two agencies (DVA and COE) require a nonproprietary electronic format (see Appendix A, Data Disks). While the DVA's format applies only to the arrow diagrams, the COE format allows for the nonproprietary specification and use of commercial scheduling software. Offices not using the DVA or COE formats often, and incorrectly, use proprietary data exchange specifications.



## **Changing the Project Plan**

Initial construction schedules are merely the contractor's educated guesses about the actual method that the contractor may ultimately use to complete the project. As the project moves from mobilization through construction to commissioning and financial close-out, changes to the construction schedule will be needed. Federal specifications provide guidance on the responsibility for and conditions under which schedules may be modified to reflect job-site conditions.

### ***Requesting Time Extensions***

Changes to project schedules often reflect additional work or changed conditions to the original contract plans and specifications, so the changes need to be incorporated into the schedule to determine the impact of the changes on the overall project duration. Many agencies require the contractor to use the schedule to justify any requests for additional time (see Appendix A, Justification of Contractors Request for Time, Justification of Delay). Contractors who created reasonable initial schedules and correctly updated their schedules will more easily justify time extensions because the only issues that will be argued are which individual activities are affected by a change and the extent of that effect.

### ***Incorporating Directed Changes***

A contractor is sometimes directed to begin work without settling on the cost of that work. In these cases, the government often reserves the right to have the contractor make specific "directed changes" to the schedule (see Appendix A, Planning for Directed Changes).

### ***Incorporating Approved Changes***

During the project update period, contractors are expected to incorporate all approved change orders into the project schedule. These changes may include the addition, deletion, or modification of several activities. Logic changes may also be made as a result of approved changes. The contractor is usually required to identify these changes (see Appendix A, Approved Changes Verification).

### ***Incorporating Work Disruptions***

Disruptions in construction projects are the rule rather than the exception. An extended period of poor weather, for example, may be a disruption to be included in the

schedule. Work disruptions should be reflected in the construction schedule to determine the impact of the disruption on interim milestones or the overall project completion date (see Appendix A, Work Disruptions). A new activity that represents the weather delay should be added to the schedule, and all those activities impacted by the delay should be sequentially linked to the delayed activity.

## 4 Survey of Scheduling Practices

The specifications described in the previous chapter represent the official guidance of each agency regarding project scheduling. To develop an understanding of how the specifications are used by construction office personnel, a survey (Appendix B) was developed and mailed to all representatives of the committee. Table 2 lists the 62 respondents to the survey and their agency affiliations.

All surveys (including those from the DVA and Department of State) were completed by personnel who are or recently have been involved in the daily administration of progress schedules. The discussion below describes the way individual offices have actually implemented scheduling specifications at those offices responsible for monitoring progress schedules.

**Table 2. Scheduling survey responses by agency.**

Army, Corps of Engineers	21
National Aeronautic and Space Administration	16
Voice of America	13
Naval Facilities Engineering Command	8
Department of Health and Human Services	2
Department of Veterans' Affairs (HQ)	1
State Department (HQ)	1

### Fixed-Price Contracts

The typical construction process in the U.S. construction industry involves three phases: designing, bidding, and constructing. The most common form of construction contract in the United States is the fixed-priced contract under which a contractor agrees to provide all resources and personnel required to construct the project described by a set of plans and specifications within a given period of time.

### *Relative Size of Projects*

An important aspect of a project, from a scheduling point of view, is the size of projects typically completed at an office. Therefore, the first portion of the survey attempted to identify the range of projects completed at each responding office. Figure 1 graphs the typical size of small, medium, and large projects at each office. While six offices had very large construction projects, most offices appeared to have smaller projects.

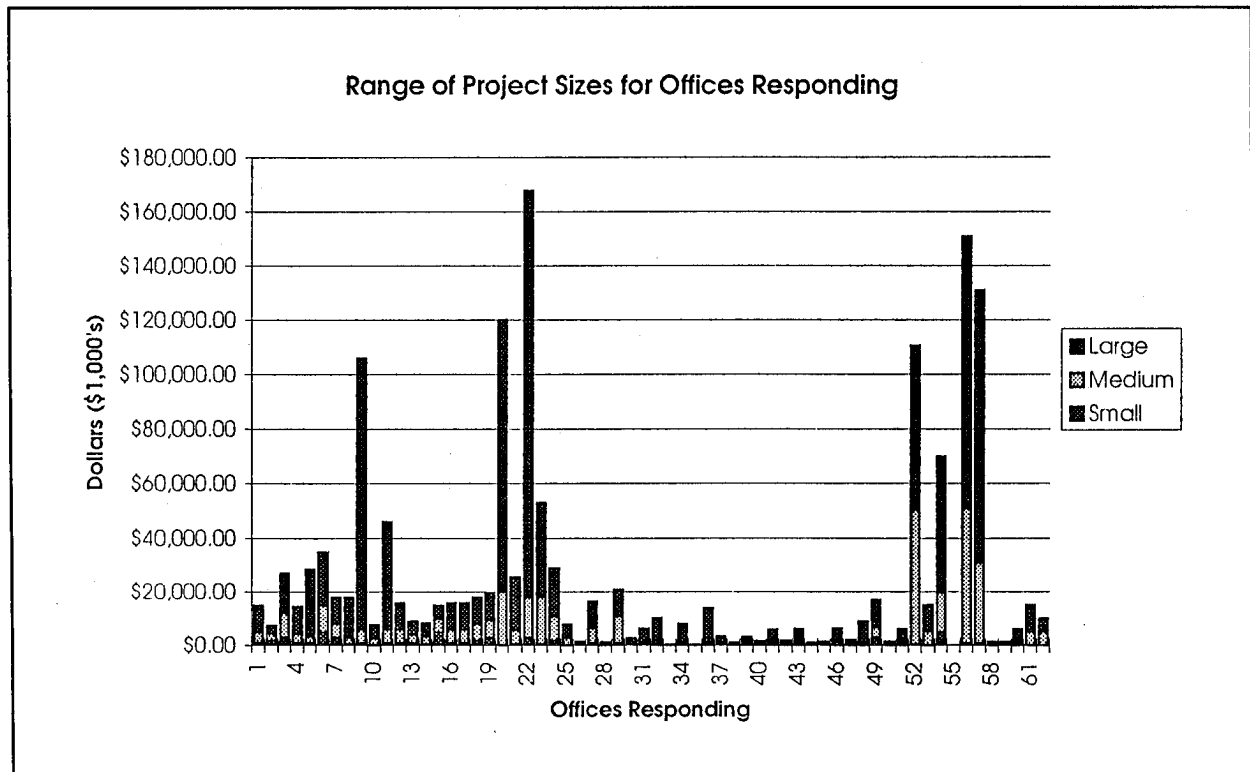


Figure 1. Size of fixed-priced projects.

Figure 2 expands the view of those offices with smaller projects by providing a log-scale view of the project comparisons. The log scale also shows that most offices have a significant range of projects. A wide difference in the administration of large and small projects would be expected, so the variety of construction work accomplished at the offices illustrates the office staffs' need to correctly customize the specifications for each project.

Most specifications are customized by A/E firms during the design phase of the project. Guidance to the A/E firm on scheduling specifications is based on the personal preferences of agency staff. While the use of personal preferences is a good practice, generally, because it allows an office to be internally consistent and consistent for projects across a geographical area, modifying scheduling specifications based on personal preferences does allow offices to continue to use incorrect practices, such as proprietary data exchange specifications.

Figure 3 benchmarks the sizes of projects at the responding offices by agency affiliation. The office with the largest projects is the DVA. The large size of these projects is not surprising considering that the DVA's single response was submitted from that agency's national scheduling office.

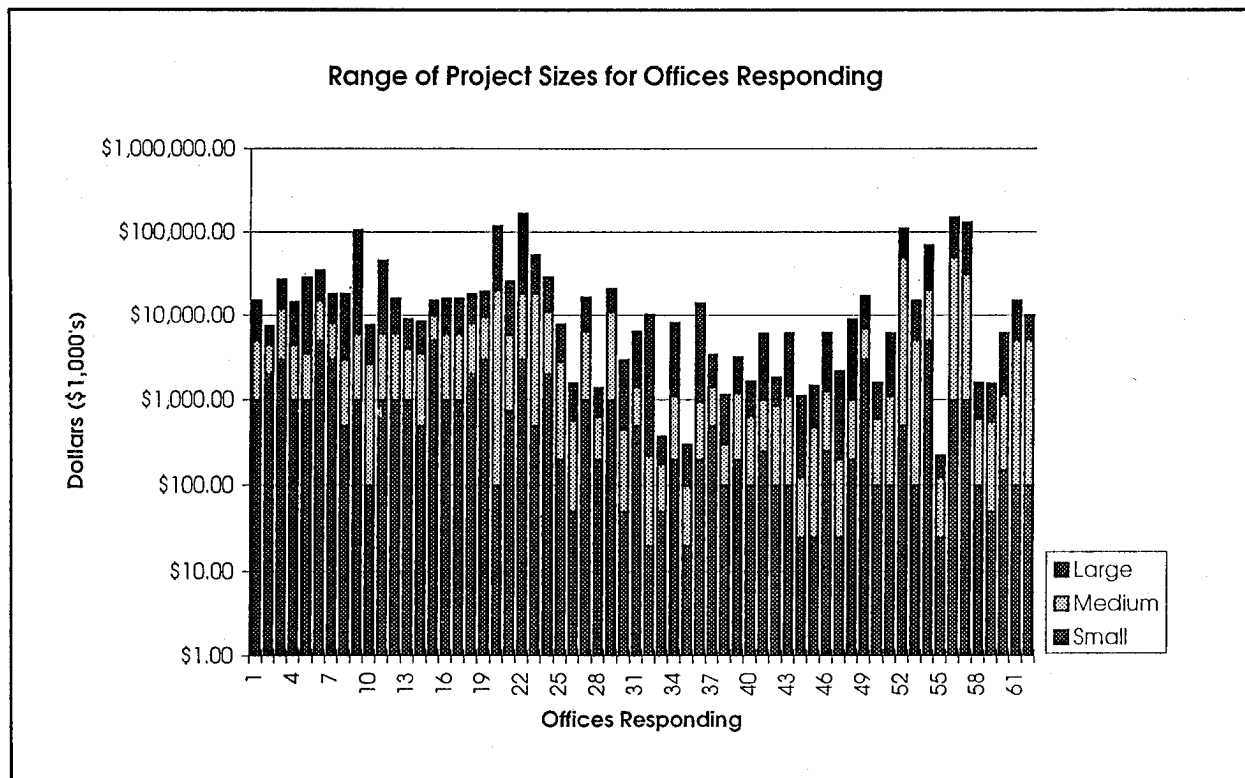


Figure 2. Size of fixed-price projects (log scale).

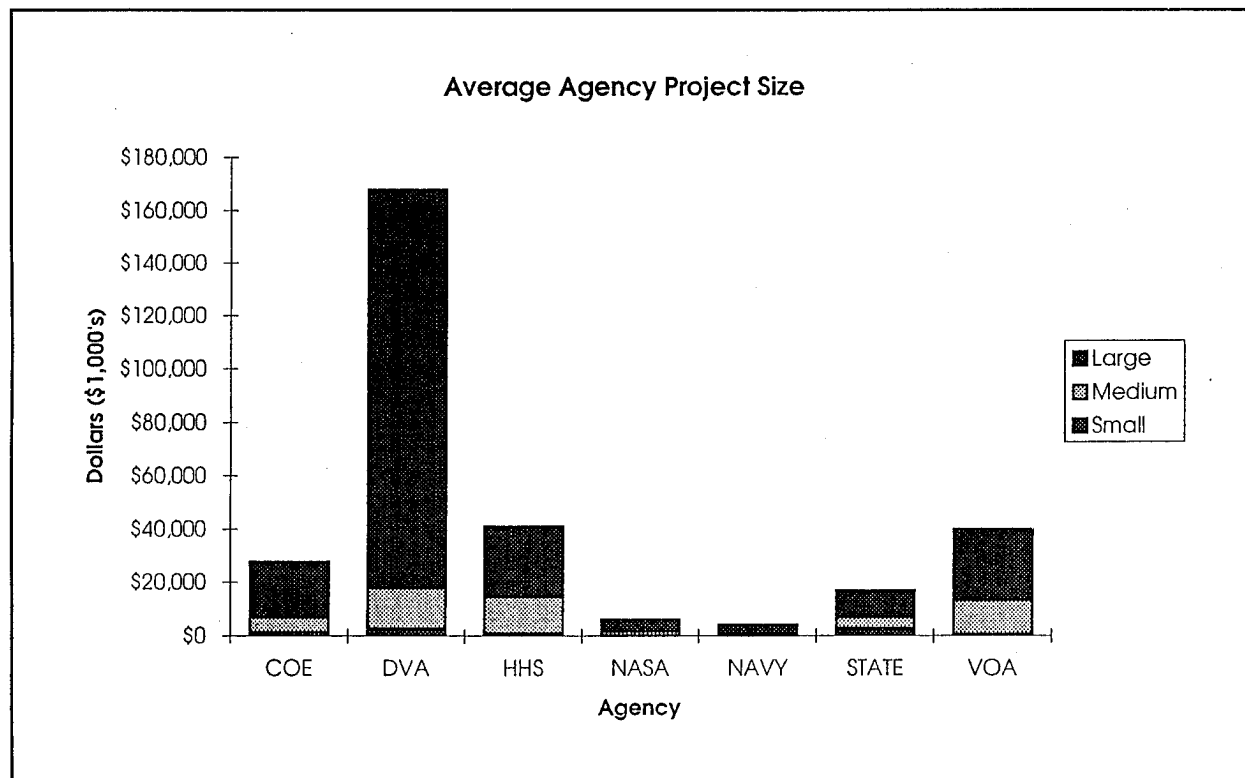


Figure 3. Average project size by agency.

Depending on the particular operations of the agency, size of project may also have been adjusted down. For example, the construction at several agencies (i.e., NASA and NAVFAC) includes maintenance and operations types of projects. These small projects often are not included in the work of the COE and DVA where site offices are responsible for maintenance contracts.

### ***Planning Methods Used***

An evaluation of the types of project planning methods used was conducted based on projects under \$1 million and projects over \$1 million. This level seemed to be a good breaking point between projects because many offices have statutory considerations for projects over \$1 million. More than 80 percent of offices responding had projects under \$1 million.

Of the 51 offices that had projects under \$1 million, more than three-fourths required bar charts. Five of the 51 offices reporting projects under \$1 million required arrow or precedence diagrams for their projects. Only four of the offices managing small projects did not require any type of project planning.

One item of note: No office specified using the fenced-bar chart to plan small projects. The fenced-bar chart (Figure 4) provides a significant improvement over the bar chart for project planning because the bars are tied together with vertical lines to show the sequence of tasks through a project. With the fenced-bar chart, all project participants might be able to see the impact of delays to activities on the overall project. For example, the activity "Deliver Material" is on the critical path of the project and cannot be delayed. On the other hand, the activity "Excavate" has a significant amount of float and does not need to be started immediately at the beginning of the project. With a fenced-bar chart, the simplicity of the bar chart is combined with the power of the CPM in a form that is easy to use and understand.

The fenced-bar chart may also be created from many CPM scheduling systems. These diagrams are often referred to as "time-scaled" network diagrams. While the time-scaled network diagram may be a useful selling point for software systems, actually getting the software to produce readable diagrams on large projects requires significant effort. One scheduling consultant reported that having draftsmen draw network diagrams by hand is less expensive than tinkering with the settings of scheduling software to produce time-scaled network diagrams. The most appropriate use of the time-scaled network diagram is to show segments of large projects. Showing these segments (i.e., activities related to an upcoming change order) is a very powerful communication tool. The importance of the fenced-bar chart technique is that the

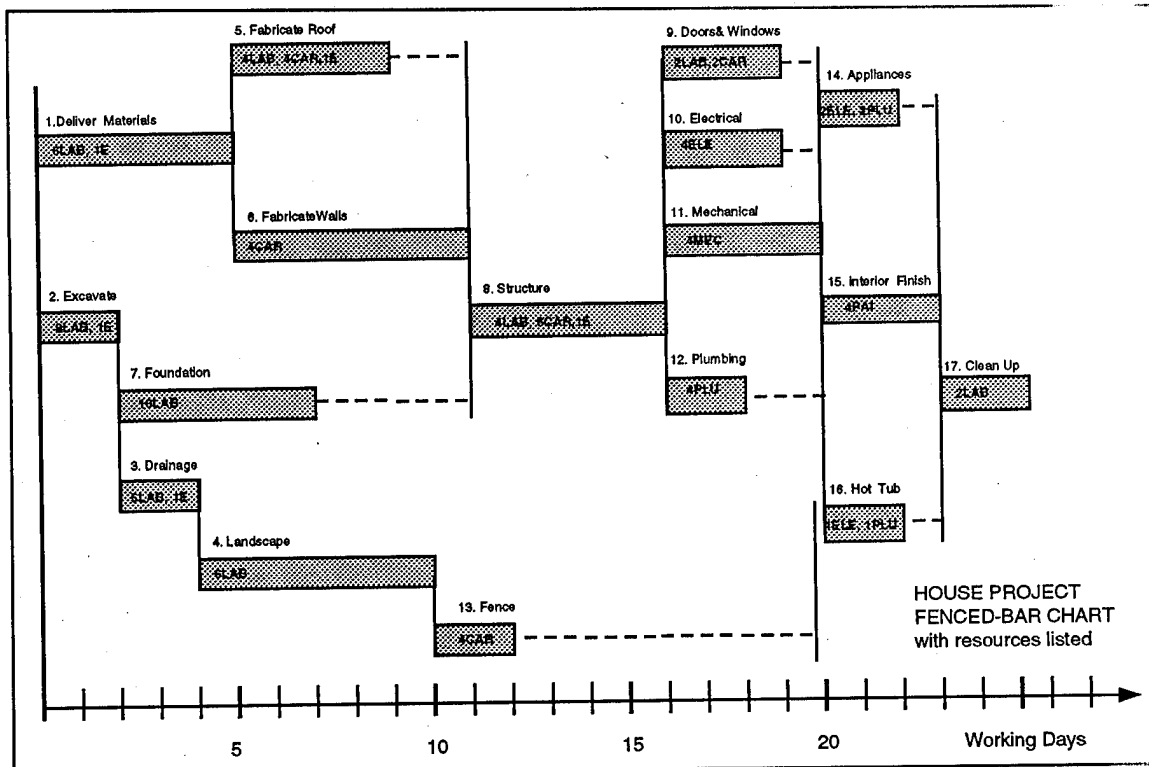


Figure 4. Example of a fenced-bar chart.

contractor may create the chart by hand, if needed, for use on small jobs where the CPM network is not required.

Of the 57 respondents who had projects over \$1 million in size, only four relied solely on bar charts. Over three-fourths of offices used the precedence diagramming method (Figure 5). Over one-fourth of large projects could have been scheduled using an arrow diagram (Figure 6). Over 10 percent of the offices asked would allow schedules to be submitted in either arrow or precedence diagram formats.

Another scheduling technique that has not been used by Federal agencies is the LOB method. As shown in Figure 7, the LOB method uses the x-axis of the chart to indicate time and the y-axis to indicate the work areas for the project. The construction work is shown on the diagram using lines that start in the first work area and progress through each area. The slope of the lines is based on the productivity rates of the crews for the given tasks.

Work flow lines may be broken (as shown in Figure 7) if work with rapid productivity follows work with slower productivity. Using this technique, contractors can immediately recognize bottlenecks in work flow.

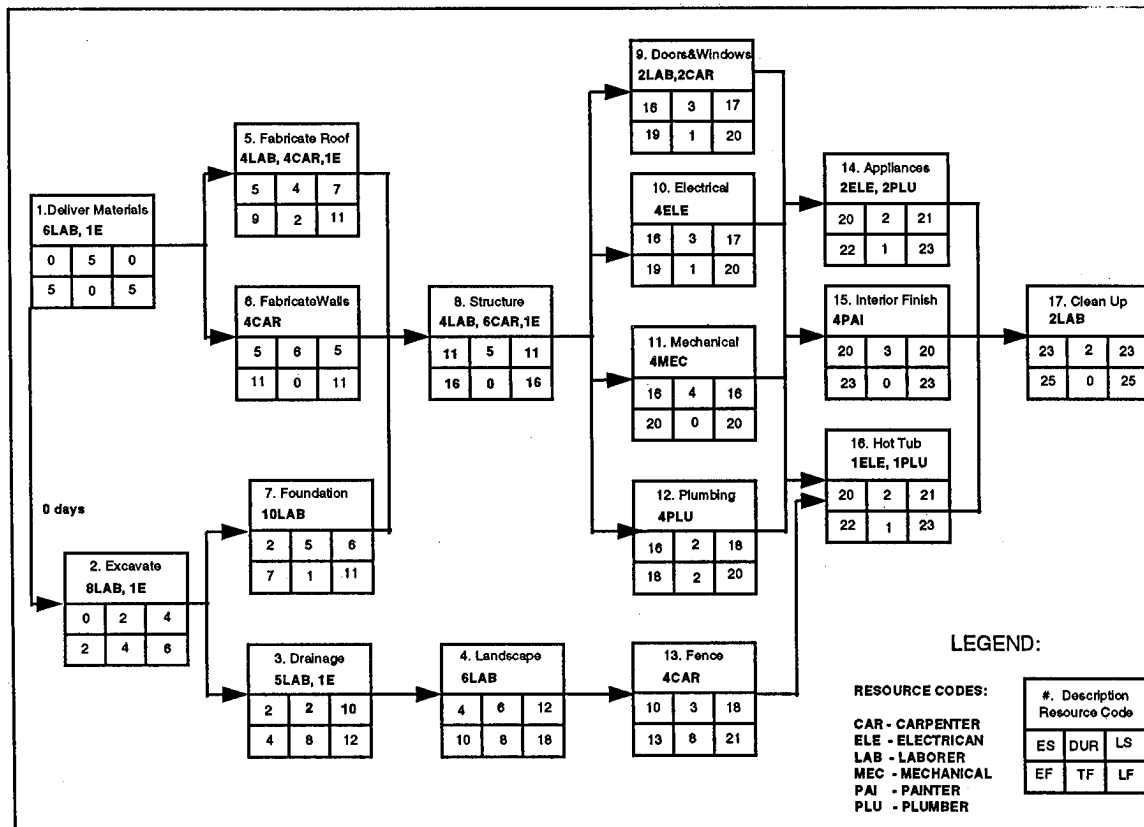


Figure 5. Precedence diagram method.

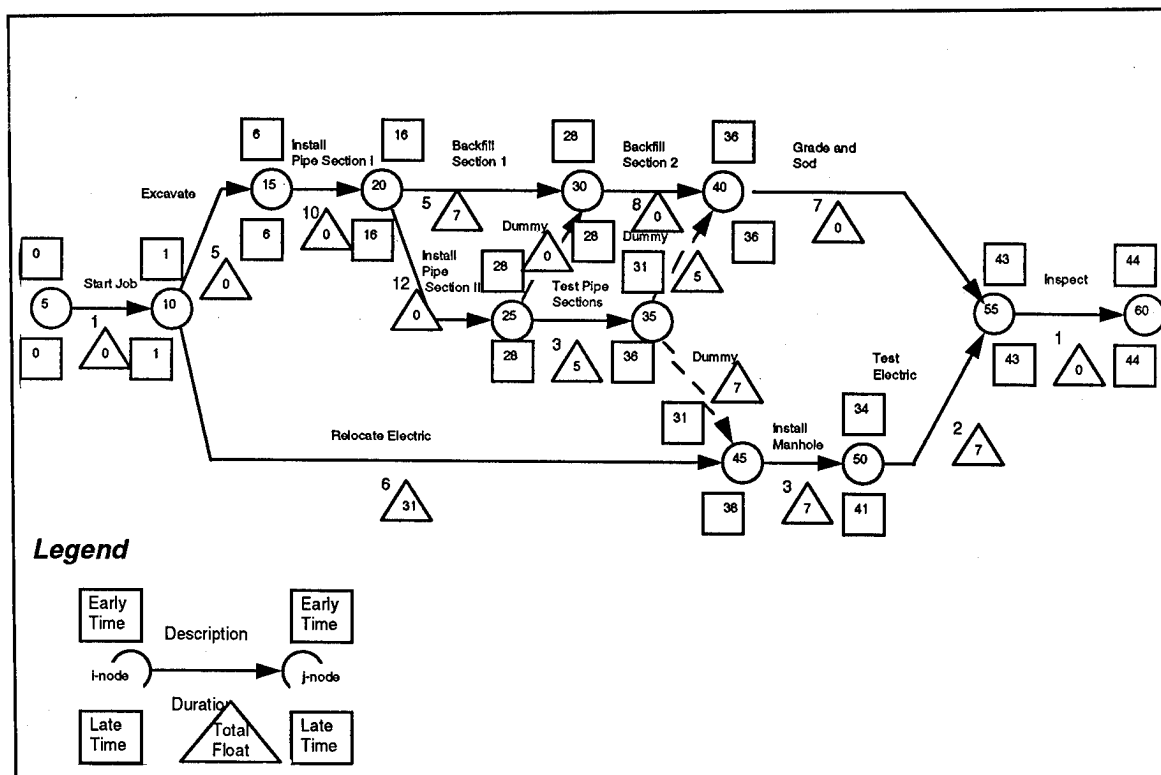


Figure 6. Arrow diagram method.



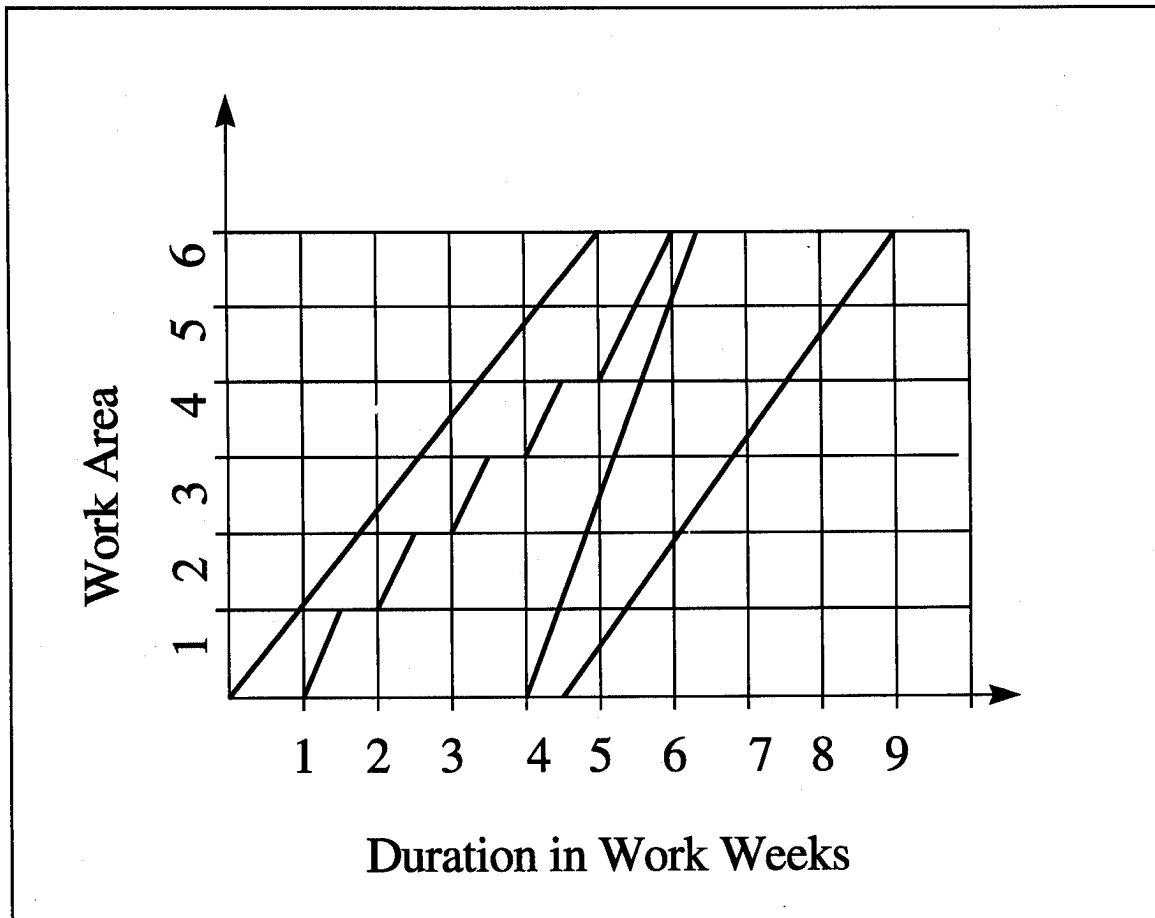


Figure 7. Line-of-balance method.

In Figure 7, the first activity in the schedule starts at time zero at the beginning of Work Area 1. The activity progresses at the rate of one work area per week to complete Work Area 6 on Week 6. The second task begins at the end of Week 1, after the completion of the first task in Work Area 1, and proceeds at a rate of two work areas per week. Of course, the second activity is delayed since its production rate is twice as fast as its prior activity. The breaks in the second activity represent the float between the tasks when scheduled at their early start date. The activities beginning on Weeks 4 and 5 proceed uninterrupted through the work areas.

The LOB method allows work plans to be developed for projects that are often unsuited to the development of discrete task lists or repetitive work across many work areas. Heavy and highway construction, for example, have resisted the use of CPM because these types of projects are more process-oriented than task-oriented. Vertical projects, which can be broken into tasks, can still benefit from the simple and clear presentation of an LOB project schedule.

### ***Schedule Detail***

Projects using arrow and precedence diagrams often have specifications that explain how the project is to be organized. As the number of activities increases, the need to be able to extract the subset of tasks of interest becomes more important (see Chapter 2, **Level of Detail**).

Table 3 lists the relative usage of the various activity codes included in the discussion of fixed-priced construction contracts. From the relative importance of the different activity codes, it appears that government representatives are concerned with the overall project goals and not with the details of the project. Project milestones ranked as the most important item to be included in the schedule with major procurements following closely.

The two codes, Work Area and Trade, may be used to evaluate the reasonableness of a contractor's work plan. Using the two codes, the scheduler may evaluate how a contractor is to take a crew or crews and move them from the first work area, through the project, and then off the job to the next job. On relatively large projects, government personnel do not have sufficient time to evaluate the contractor's work flow. On very large projects (over \$100 million), however, where the government often has a full time scheduler, only 40 percent of the projects require work area and trade codes. Without the information provided by work area and trade codes, it would be nearly impossible for government personnel to perform an effective evaluation of the contractor's work plan.

It is recommended that government agencies develop project scheduling training for very large projects as the type of course suggested is not available through commercial software vendors. Commercial vendor courses and user groups typically attempt to sell proprietary software systems, provide forums to discuss specific software features, or are too general.

### ***Submission Requirements***

One of the more significant decisions regarding schedules is whether to require monthly submission of the schedule or to require that the contractor submit only an initial plan. The evaluation conducted for this project primarily focused on the use of the schedules on projects over \$1 million as a tool to evaluate contractor progress for payment purposes.

**Table 3. Activity code use.**

<b>Activity Code</b>	<b>Usage (%)</b>
Milestones	93
Major Procurements	89
Phase of Work	74
Government Furnished Equipment	70
Work Area	68
Trade or Responsibility	53

Over 80 percent of agencies appear to use the progress schedule as one portion of the data required to assess the fiscal progress of the contractor. Contractors on those projects are required to submit an initial schedule, provide monthly updates, and the schedule updates are used as the basis for contractor payment.

While the majority of offices required cost-loaded schedules, fewer offices used the schedules as the basis for contractor payments. The contract value of \$5 million appeared to be the cutoff point for consistently updating schedules. Contractors for over 90 percent of projects over \$5 million were required to provide monthly updates. Contractors for projects between \$1 million and \$5 million were only required to provide monthly updates 50 percent of the time.

When updating schedules, it is crucial that the schedule be changed to reflect current project conditions. While there may be differences of opinion regarding claims, there should be no need to discuss changes to the schedule based on approved contract modifications. Only 70 percent of offices, however, required contractors to include approved changes to the schedule. Again using the \$5 million cutoff point for additional evaluation, over one-third of contracts between \$1 million and \$5 million did not include approved changes nor use the schedule for the evaluation of large changes. For projects over \$5 million, more than 20 percent of projects did not include approved changes or use the schedule for the evaluation of changes. While the level of attention paid to the schedule would be expected to increase for larger projects, 30 percent of projects over \$100 million did not include approved changes.

The number of large projects that did not include approved changes nor use the schedule for claims evaluation is surprising and indicates the need for significant improvements in Federal scheduling practices.

### ***Submission Formats***

Bar-chart submissions need be no more than a marked-up copy of the previous bar chart. The bar chart may, however, need to be redrawn to add new activities or show significant changes to current activities. While a detailed evaluation of smaller projects was not conducted, it was interesting to note that requirements to update bar charts were not found in the specifications. Updates to bar charts and progress narratives should be required on a periodic (typically monthly) basis.

The format of schedule submission is important when arrow or precedence diagrams are specified because that submission is to be used, in most cases, to judge the contractor's progress for payment purposes. Only two-thirds of all respondents indicated that they received paper reports documenting the contractor's progress. Many of these

respondents appear to have supplanted paper reporting, particularly on larger projects, with electronic schedule submissions.\* Over 86 percent of offices with projects of over \$5 million contained requirements for submission of data disks.

As for submissions of progress narratives, over 80 percent of projects over \$5 million require these brief, written progress reports. The narrative is required on 70 percent of all projects between \$1 million and \$5 million. The importance of these narratives cannot be overstated for documenting progress on large projects while the project is in progress. Such documentation is inexpensive compared to the cost of reconstructing a project for the purposes of evaluating claims.

Submission of the network diagram was only 53 percent for projects between \$1 million and \$5 million and 70 percent for projects over \$5 million. Keeping the production of these expensive and often confusing plotted charts to a minimum should decrease the contractor's schedule administration costs. One scheduling consultant continues to manually draft the schedule because computer generated plotting routines frequently provide diagrams with many crossing lines unless the scheduler first converts a reasonably drawn schedule into the system.

A more important report that could and has been used in many offices to replace the network diagram is the look-ahead bar chart. Supported by the majority of scheduling software systems, the look-ahead bar chart allows users to see those tasks that are to start and finish within the next progress update period.

One caution regarding the use of data disks: Many agencies require contractors to provide data in proprietary data formats. Since proprietary specifications are illegal, agencies with these proprietary specifications are open to claims from a variety of sources. Only the DVA and the COE have published nonproprietary data exchange formats.

### ***Contractor Staffing Required***

Various levels of staffing requirements are placed on contractors. In the least restrictive case, contractors may use whomever they wish, provided a resume is submitted and approved by the agency representative. More restrictive requirements are for contractors to hire scheduling software consultants or provide onsite resources to coordinate the development and production of the schedule.

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\* Note that statistical testing to validate this hypothesis was not conducted because of time limitations.

The first result from the survey was that 14 percent of responding offices do not require the contractor to provide any type of scheduling experience on the project. Unfortunately, these offices will probably receive schedules that are used only for administrative purposes and not for project management and planning.

It is recommended that all projects over \$1 million have a scheduler of the contractor's choice who must, at a minimum, submit a resume for government approval to ensure that the person producing the schedule has a basic understanding of scheduling.

The contractor is required to hire a consultant by 40 percent of all offices. Fifty-four percent of offices require the contractor to have an onsite scheduler. Several offices require the contractor to use a scheduling consultant without consideration for an in-house, onsite scheduling staff.

Because schedule consultants may not develop well coordinated schedules and add administrative costs to the project, it is recommended that contractors be allowed to use in-house or consultant services. Ultimately, the schedule is for the contractor's use in coordinating their work plan and measuring progress, so whatever method the contractor wishes to use should be permitted.

## **Computer Usage Issues**

Use of computer software is the only practical way for large schedules to be properly evaluated. The 57 respondents who had projects above the \$1 million threshold were evaluated for this section. The proper use of scheduling software is essential to adequately represent the project. In some cases, specialized computer scheduling techniques may be used to hide the lack of progress made by contractors. As with any other tool, the safe use of scheduling software tools requires that the software operators fully understand where problems are and how the problems may be avoided.

### ***Project Milestones***

Correctly modeling the project's starting and ending dates and contractually required interim milestone dates is the first essential step in correctly calculating the schedule. Different scheduling systems use general project dates in different ways, so it is important to specifically state how project milestones should be included in the schedule.

Survey data indicated that more than 35 percent of offices do not properly constrain the project start date. Almost one-fourth of offices do not require the contractor to add

the project completion date into the schedule. Ensuring that interim milestone dates are correctly entered in the schedule is addressed in 44 percent of offices.

### ***Calendars***

Many software systems allow the use of multiple types of calendars that are typically used to represent different types of work crews. For example, one crew may be working five 8-hour days and another crew may work four 10-hour days. A 7-day work week is also included for activities (such as concrete curing or procurement) that are usually modeled with calendar days. Over half of the offices responding to the study indicated that they did not address the calendar issue.

Incorrectly using multiple calendars is a significant problem on construction projects when delays occur. Fifty-eight percent of respondents indicated that they did not address using calendars to show extended nonwork periods. The most clear and accurate procedure is to add a new "delay" activity into the schedule, and then link impacted activities to that delay activity. Nonwork days associated with calendars can be used, in some software, to simulate the impact of a delay by not allowing work to take place on those days. Schedules manipulated using calendars to show extended nonwork periods are difficult to analyze because calendar data is usually not provided on schedule reports.

### ***Schedule Calculation Issues***

When evaluating the computer scheduling issues addressed at construction offices, the most interesting result is that over three-fourths of offices do not require contractors to supply actual start and finish dates for activities. These offices allow default calculation methods to develop artificial start and finish dates based on built-in rules in the software systems. Without accurate measurement (plus or minus 1 week for start and finish dates) of actual progress, the schedule becomes strictly an administrative burden and not a project planning and control tool.

The differences between cost and time completion also were not addressed by 40 percent of all offices. Allowing "100-percent complete" to represent the completion of an activity does not take into account the fact that the Earned Value and remaining duration of an activity may significantly differ. The difference between Earned Value (fiscal completion) and remaining duration (physical completion) can significantly impact the accuracy of the schedule by showing the contractor to be further ahead of schedule than would be apparent by evaluating physical progress on the job.

Two somewhat technical schedule calculation issues that also frequently distort schedules, negative lags (see p 17) and out-of-sequence progress (see p 17) are not being addressed by almost 45 percent of all offices.

### ***Summary Activities***

While the previous sections focused on some areas where computerized schedules are able to cause problems for the project team, the use of summary activities allows schedule data to be much more widely used at various levels of management. "Hammock," or summary activities, take their start and finish dates from the activities to which the hammock activity is linked. Hammocks are required to be used by 23 percent of offices.

Offices may want to consider using summary activities for all phases of work, work areas, and trades. Using these summary activities, general progress charts may be created that allow an easy explanation of the project without a discussion of every activity in the schedule being necessary. Offices may want to set aside specific activity numbers to allow easy identification of summary activities.

## 5 Conclusions

In general, the requirements for scheduling Federal fixed-priced construction contracts appeared to be generally consistent across agencies and in keeping with typical construction industry usage. Bar charts were used for most projects under \$1 million. Arrow or precedence diagrams began to be required for projects over \$1 million and are required by all.

### Scheduling Specifications

Members of the Project Management Committee of the FFC have indicated that the collated agency scheduling specifications (Appendix A) provide a useful reference for new project offices that are developing scheduling requirements. The collated specification is a baseline from which agencies may evaluate their specialized requirements.

### Survey Results

Survey responses were not received from each authorized contracting officer representative at every construction agency in the Federal government, so the survey is not a complete evaluation of Federal construction practices. Results do, however, represent the use of scheduling at the responding agencies. This assertion is based on the review of the draft report by all survey respondents who provided a complete address and a review of the results by other members of the Project Management Committee. Rather than describing the definitive description of how Federal construction projects are scheduled, the survey results may be used to provide a general approach used by seven Federal construction agents.

### Areas Of Concern

The primary shortcoming of the scheduling requirements for many Federal agencies is that the agencies require the use (explicitly or implicitly) of specific scheduling software. This proprietary requirement is not consistent with performance specifications used on all other areas of construction contracts. Since generic formats from DVA



and COE are incorporated into the majority of construction-related scheduling software proprietary specifications are not needed.

Through use of complex scheduling software, it is possible to hide progress problems through direct manipulation of activities, by changing parameters of calculation methods, or by inaction on the part of the user. While large projects have the overhead to support a fully trained staff that uses CPM effectively, a significant gap appears to exist between the capability of the software systems and users' abilities for small- to medium-sized projects.

### **Integration of Construction Office Information Systems**

During the review of this report by members of the FFC, recognized the need for training recommended in the next chapter. Many construction office users may only need to use large, complex CPM schedules occasionally, however, so training should be provided only at the start of a large, complex CPM schedule.

Alternatives to organization-wide, expensive, specific training programs developed by COE are office information systems that directly incorporate scheduling project planning data. Developed to support construction office staff, the COE Resident Management System (RMS) takes data from a nonproprietary scheduling data exchange format and uses the data to produce contractor payment estimates and quality assurance reports. With progress schedule data being incorporated into standard office information systems, the data becomes part of the user's standard procedures and not a specialized part of their jobs only useful for larger projects. The integrated use of scheduling data, along with automated schedule evaluation tools, should reduce the need for training in scheduling and improve the use of project planning and control across the implementing organization.

## 6 Recommendations

The following recommendations are those of the author as reviewed by the FFC members noted in the Foreword. These recommendations do not necessarily reflect the official policies of the agencies participating in the study.

1. Development of scheduling as a project planning tool by the organization responsible for completing the work should be encouraged. Because the prime contractor is responsible for timely project completion, the use of scheduling consultants should not be mandatory on Federal construction contracts. (Reference: First paragraph, p 14; third paragraph, p 34; and item 5.c., p 136)
2. CPM schedules should be used to evaluate contractors' progress for payment purposes. Training should be provided to Federal construction agencies regarding the importance of obtaining both the fiscal and physical completion of activities. (Reference: Fourth paragraph, p 14; second paragraph p 32; and item 3.a., p 136)
3. Federal agencies may consider the use of the fenced-bar chart for projects that are too small for CPM diagrams. (Reference: Fifth paragraph, p 27)
4. Federal agencies may consider the use of the line-of-balance scheduling techniques for production oriented projects in lieu of the CPM or bar charts. (Reference: Second full paragraph, p 28)
5. Activity codes allow project team members to select and sort subsets of activities based on activity codes. Training should be provided to Federal construction agents on the importance and use of activity codes. (Reference: Third paragraph, p 16; second paragraph, p 31; and item 7 on page 137)
6. Many offices do not properly specify starting, ending or interim milestones on computerized CPM schedules. Training should be provided to Federal construction agents on the use of computer software "constraints." (Reference: Second full paragraph, p 18; last full paragraph, p 34; and item 6.c., p 136)

7. Many contractors appear not to be updating schedules correctly since approved changes are required but not included in schedule updates. Many survey respondents did not require actual start and finish dates for activities and did not distinguish between fiscal and physical completion of tasks. Training should be provided to Federal construction agencies on the correct procedures for updating progress schedules. (Reference: Fourth paragraph, p 22; third paragraph, p 32; third and fourth full paragraphs, p35, and p 36; and item 3.f., p 136)
8. Many contractors appear not to be updating schedules correctly since extended periods of nonwork are not explicitly represented in the schedule. Training should be provided to Federal construction agencies on the appropriate representation of significant schedule delays. (Reference: Last paragraph, p 22 and p 23; third paragraph, p 32; and item 6.d., p 136)
9. Many offices require contractors to submit a significant number of paper reports. The requirement for paper reports should be replaced with the submission of a data disk, a very limited set of paper reports, and progress narrative. (Reference: Fourth full paragraph, p 20; and item 4.a., p 136)
10. Scheduling specifications should be performance-based, without proprietary requirements. Awards of any contract containing proprietary specification may be protested, so offices choosing to include proprietary requirements do so at their own risk. The COE Standard Data Exchange Format should be specified to promote full and open competition for all contractors and software vendors. (Reference: Last paragraph, p 21; fourth full paragraph, p 33; and item 4.d., p 136)

## Appendix A: Collated Project Scheduling Specifications

### General

[COE: The progress chart to be prepared by the Contractor pursuant to the Contract Clause, "SCHEDULE FOR CONSTRUCTION CONTRACTS" shall consist of a project schedule as described below. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project should also contribute in developing and maintaining an accurate project schedule.]

[GSA: The responsibility for the development of the network plan and schedule is solely that of the Contractor. PBS personnel should become thoroughly familiar with such scheduling to insure there exists a mutual understanding of the Contractor's plan for proceeding with the work, to be able to check the Contractor's claim values of completed work, and to insure that the Government will not unknowingly take actions that will adversely affect the Contractor's plan.]

[HHS: By execution of the Contract, the Contractor acknowledges that he has analyzed the work, the materials and methods of construction involved, the availability of skilled and unskilled labor, restrictions of the site, constraints imposed by the contract, his own work load and capacity to perform the work, and agrees that the specified times are reasonable considering the existing conditions prevailing in the locality of the work, including weather conditions and other factors, with a reasonable allowance for variations from average]

[NAVY: This guide specification covers the preparation and use of a contractor prepared Network Analysis System (NAS). As prescribed in FAR 36.515, the Contracting Officer may insert the clause "Schedules for Construction Contracts" (FAR 52.236-15) in solicitations and contracts when a fixed-price construction contract is contemplated, the contract amount is expected to exceed the small purchase limitation, and the period of actual work performance exceeds 60 days. This clause may be inserted in such contracts when work performance is expected to last less than 60 days and an unusual situation exists that warrants impositions of the requirements. This

clause should not be used in the same contract with clauses covering other management approaches. Coordination is required with general paragraphs section when NAS is not specified.

Prepare a progress chart pursuant to the clause entitled, "FAR 52.236-15, Schedules for Construction Contracts" of the Contract Clauses that shall consist of a network analysis system. Include scheduling of construction, creation of the network, production of the reports, execution of the plan described by the network, participation in meetings with the Contracting Officer, and submission of progress and revision data, as hereinafter set forth.]

**[POST:** Contracts for repairs and alterations do not always include a general provision for a progress schedule because a majority of these contracts are not complex, are short in duration, and usually involve only one payment. When a requirement is included in these contracts for a progress schedule, the schedule may be a simple bar chart, but the procedure for review, update, and revision will be the same.

After review, the project manager forwards the initial schedule, with recommendation for acceptance or rejection, to the contracting officer (CO) for approval. The contractor updates the approved schedule to reflect actual progress and submits it with each monthly progress payment request.]

**[STATE:** A decision to shift from the traditional bar-graph form of progress scheduling, to a computerized CPM form, should not be made with anything less than total concern for how it might affect the overall project. Consensus appears to favor CPM scheduling for large dollar-volume, complex, difficult-to-execute, projects. For anything less, this is likely to cost more, and produce no significant reduction of time, or other benefit. The problem here is that, in general, only the larger and more capable contractors and subcontractors can be depended upon to respond properly to CPM procedures; this is regardless of whether a decision has been made to engage a separate firm to implement and manage the CPM program (may be a construction management firm). In any case, where time is of real concern, the project must get started by using traditional scheduling for early work; then following with a full-blown CPM procedure where that decision has been made. All elements, including separate contracts, Government purchases, security procedures, etc., must be entered into the schedule. The system is doomed to failure if anything is omitted; e.g., when the separate contract work for RF/RFI/Tempest shielding is omitted, simply because it is "classified."]

**[VA:** The A/E shall be responsible for recording the phasing requirements and in submitting the material listed below under phasing submission requirements. The

A/E shall participate in the phasing meetings with the Medical Center personnel in an advisory and technical capacity to the Contracting Officer.

The A/E shall submit for review by the VA CPM Staff, a phasing narrative and phasing plans (on reduced architectural floor plans) within two weeks after each phasing meeting(s). The CPM Staff will review these submission(s) for return to the A/E within two weeks of receipt. The A/E will then use this information in preparing their schematic, design development and construction document submissions.

#### I. FIRST/SECOND SUBMISSION OF SCHEMATIC AND FIRST SUBMISSION OF DESIGN DEVELOPMENT PLANS

##### First/Second Schematic and First Design Development Plans

##### -Phasing Narrative

##### Submission Requirements:

- Phasing Plans (on reduced architectural floor plans)
- Phasing Diagram
- Phases marked on all full size drawings submitted for VA review
- Written list of systems, including temporary system by phase, and separated by technical discipline

Prior to the first and second submission of schematic plans, the A/E and his design consultants, along with representative(s) of the Area Project Manager's staff; Director, Office of Planning and Development, and CPM Staff; shall meet with the Medical Center Director and his staff to discuss and outline phasing requirements for the project. These phasing requirements shall describe the general sequence of the project work, estimated project duration, and what Government constraints will exist that will influence the Contractor's approach to the construction project. In addition, special attention shall be given to asbestos abatement requirements to ensure that the project phasing plan and associated costs are reasonable. Adequate time shall be allocated for the evaluation of asbestos abatement areas (where required) in addition to the time to perform the asbestos abatement work that must precede the general construction. In response to these meetings the following shall be submitted at the first and second schematic and first design development submissions:

- a. Phasing Narrative (sample 'a', attached) in written form which outlines phasing requirements and sequence with all areas of the project identified as a part of some phase. Each phase description shall include constraints particular to that phase, what other phases must precede it, and any VA moves which must precede the start of the phase or phases. If equipment and other removable items require storage

and relocation by the Government, because of asbestos abatement, these requirements shall be listed in the phasing narrative. Special phasing constraints which may be common to the project should be listed at the end of the narrative and not within each individual phase description.

b. Individual Phases shall be outlined and labeled on all the submitted schematic and first design development plans including site, architectural, structural, HVAC, plumbing, and electrical drawings. NOTE: Phases shall be outlined on the submitted full size drawings. Submit a separate set of phasing plans (sample 'b' architectural drawings attached).

c. All engineering systems shall be designed so that, upon completion of a particular phase, the entire area covered by that phase can be occupied by the Medical Center personnel with all systems functioning properly. (The design may be such that a temporary system is necessary, which will be changed to a permanent system at some later point in the project. This temporary system must be satisfactory to provide proper functional and environmental conditions within the occupied space or the facility until the final system can be installed without major interruption of service). The A/E's submission shall highlight in writing (by technical discipline) for each phase all solutions including temporary solution(s) required to accommodate the phasing plan while keeping all systems functioning properly.

**JOINT OCCUPANCY** - Those area(s) designated as being jointly occupied means that the contractor will be able to complete the work necessary in the building(s), room(s), or area(s) designated in particular phase, while remaining occupied by the VA personnel and/or patients. The contractor shall, in all jointly occupied area(s), protect VA personnel/patients and existing equipment from the hazards of dust, materials, tools, etc., associated with a construction environment. The contractor shall keep these jointly occupied area(s) clear, clean, and free of loose debris, construction materials, and partially installed work which would create a safety hazard or interfere with VA personnel or patients. The contractor will pay particular attention to leaving these jointly occupied area(s) clean at the end of each work shift.

**VACATED AREA(S)** - Those area(s) designated as being vacated area(s) means that the contractor will be able to complete the work necessary in the building(s), room(s), or area(s) designated in a particular phase, without the presence of VA personnel and/or patients. In area(s) of limited work, the contractor shall protect existing equipment from the hazards of dust, materials, tools, etc., associated with a construction environment; however, the contractor will be required to observe any restraint(s) outlined under the "Special Phasing Requirements," section 01010, of the Contract Specifications.

**ROOM-BY-ROOM BASIS** - Those area(s) designated as being completed on a room-by-room basis means that the contractor will be allowed to complete the work necessary in that room, whether the particular room is a 'jointly occupied area' or a 'vacated area', and that all work in that particular room must be completed in full and accepted by the VA prior to starting work in another room so designated in that particular phase. The contractor will observe those phasing restraint(s) outlined and pertaining to 'jointly occupied' areas or 'vacated area(s)' under the "Special Phasing Requirements," Section 01010 of the Contract Specifications.

**AFTER NORMAL WORKING HOURS** - Those area(s) designated as being worked after normal working hours means that the contractor will be able to perform the work necessary in the building(s), room(s), or area(s) designated in a particular phase, only during the hours that the VA considers to be other than their normal hours. Normal hours are 8:00 a.m. to 4:30 p.m. The contractor must allow enough time at the end of each shift to clean and return the area(s) back to the station prior to the start of the station's normal hours of operation. Existing equipment in the area(s) shall be protected from the hazards of dust, materials, tools, etc., associated with a construction restraint(s) as outlined and pertaining to these area(s), under the "Special Phasing Requirements," Section 01010 of the Contract Specifications.

f. The sample CPM Network Drawing CPM-1 is for the contractor's information. The sample network indicates the level of detail and technique which will be required on the contractor's network and described in the NAS Section of the Specifications. The CPM notes and legend on Drawing CPM-1 are contractual.]

## **Purpose**

[**COE:** The purpose of the project schedule is to allow the Contractor to prepare an orderly guide to aide in the timely completion of the project. The approved project schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.]

[**GSA:** Arrange schedule to show how sequence of work is affected by requirements for phased completion, work by separate contractors, work by Government, Government furnished items, coordination with existing work, limitations of continued occupancies, noninterruptible services, partial occupancy prior to substantial completion, site restrictions, provisions for future work, seasonal variations, environmental control, and similar provisions of total project. Refer to other sections of Division 1 and other contract documents for requirements.]



**[HHS:** C. It is expressly understood and agreed that the time of beginning, the rate of progress, and the time of completion of the work are of the essence of this Contract. The work shall be executed with such progress as required to prevent any delay to other contractors working on other projects at the site, the Contract milestone dates, and the general completion of the Contract.]

**[POST:** the contractor to prepare, submit. and maintain a construction Network Analysis System allows the contracting officer to appraise the reasonableness of the proposed schedule (see Procedure 270.10), to evaluate progress in greater detail, to effectively identify problem areas, and to resolve them before they impact project completion.

I. Schedule preparation is the contractors responsibility;]

**[VOA:** The Project Management System specified herein is intended to provide for the effective planning, scheduling, cost accounting, and reporting of the design, fabrication, shipment, installation, commissioning, and acceptance testing of the XXXXX Project. It shall be used by the Contractor to generate monthly management reports which will provide the following:

A measurement of actual performance versus targeted schedules;

A basis for assessing requests for progress payments;

An early warning system for forecasting potential problem areas; and

Additional management information which can be used by the Government to monitor and control the overall implementation of the VOA modernization and expansion program.]

## **Personnel Qualifications**

**[COE:** The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports. [ This person shall have previously created and reviewed computerized schedules. Qualifications of this individual shall be submitted to the Contracting Officer for review with the Preliminary project schedule submission. ] ]

**[GSA: General Services Administration Qualifications:** To assist in the preparation and production of network diagrams, computer-produced report sorts

required under this section engage a consultant having the following qualifications. The Contractor may perform these services with his own organization if the Contractor's organization meets the following requirements: 1. Has at least one full-time employee skilled in the application of network techniques to construction projects of the magnitude and complexity of this project; 2. Possesses or has access to a computer program for production of the required schedule reports and cost payment reports; and 3. Has computer facilities or access on short notice to computer facilities with the capability of delivering a readout within 48 hours.

Prior to engaging a consultant or commencing performance of the work required under this section with the Contractor's own forces, submit to the Contracting Officer: 1. The name and address of the proposed consultant; 2. Information sufficient to show that the proposed consultant or the Contractor's own organization has staff and computer facilities meeting the requirements specified in this paragraph; and 3. A list of prior projects for which the proposed consultant, or its own organization, or staff thereof has performed services similar to those required under this contract. The Government shall have the right to approve or disapprove employment of the consultant proposed, or the performance of the requirements herein by the Contractor's organization. ]

**[HHS:** The Contractor shall continuously employ or retain the services of a Construction Scheduler. The Construction Scheduler shall have at least five (5) years of verifiable experience as the person primarily responsible for preparing and maintaining detailed project schedules on projects of the same or similar size and nature as this project. The Construction Scheduler shall utilize and be thoroughly familiar with the use of Primavera Project Planner (P3), version 5.0 or later, as marketed by Primavera Systems, Inc., Two Bala Plaza, Bala Cynwyd, Pennsylvania 19004, telephone: (215) 667-8600, and have computers and automated drafting facilities with the capability of providing network diagrams and complete schedule reports as required by the program and this section within 48 hours.

Within seven (7) calendar days (just seven (7) calendar days) after Contractor's receipt of the Notice to Proceed, the Contractor shall provide a statement of to the Contracting Officer containing the following information: 1. Identification, qualifications, and experience of the Contractor's Construction Scheduler and all other members of the Contractor's scheduling staff. 2. A list of prior projects on which the Contractor's Construction Scheduler has performed services similar to those required in this section utilizing P3. 3. A list of computer hardware and automated drafting and report printing equipment that will be utilized to comply with this scheduling requirement.

The Contracting Officer shall have the right to approve or disapprove the use of the proposed Construction Scheduler for this project, and will notify the Contractor of its

decision within seven (7) calendar days from the receipt of the Contractor's information. In case of disapproval, the Contractor shall submit another Construction Scheduler within seven (7) calendar days for renewed consideration. No progress payments shall be made until the Contractor's Construction Scheduler is approved and has submitted an approved baseline and an updated Project Schedule.]

**[NASA:** The Contractor shall provide a single point of contact for his on-site organization as his Schedule Specialist. The Schedule Specialist shall have the responsibility of updating and coordinating the schedule with actual job conditions. The Schedule Specialist shall participate in weekly status meetings and present current information on the status of purchase orders, shop drawings, off-site fabrication, materials deliveries, Subcontractor activities, anticipated needs for Government furnished equipment and any problem which may impact the contract performance period.]

**[POST:** Unless the appointed project manager has expertise in the use of the Network Analysis System, it should be left to the construction management contractor (CMC) or A-E hired to administer the contract. They will provide monthly analysis and recommendations for review.

5. The contractor, CMC, and project manager must participate in a joint review of the requirements of the Network Analysis System as soon as possible. Contracting officer approval of the schedule and network analysis is ultimately required.]

**[STATE: A. CPM Schedule Operator:** Except where Contractor can demonstrate/document, to satisfaction of Project Director, that in-house personnel are sufficiently expert in practice of establishing data bases, preparing inputs, updating, and evaluating/analyzing computer outputs, using a sophisticated CPM program; engage a recognized CPM consulting-and-operating firm. Either the in-house expert(s) or the engaged consultant is referred to herein as "CPM operator." Submit documented record of CPM operator's training and prior experiences on similar work of previous CPM-scheduled projects, for review and acceptance by Project Director.]

**[VA: A.** The Contractor shall designate an authorized representative in the firm who will be responsible for the preparation of the network diagram, review and report progress of the project with and to the Contracting Officer's representative.

B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section and such authority shall not be interrupted throughout the duration of the project.

### 1.3 CONTRACTOR'S CONSULTANT

A. To prepare the arrow diagram, and diskette(s), which reflects the Contractor's project plan, the Contractor shall engage an independent CPM consultant who is skilled in the time and cost application of activity on arrow (I-J) network techniques for construction projects, the cost of which is included in the //(I) Contractor's bid. //(ii) original contract price. The CPM Consultant shall prepare the arrow diagram in accordance with the networking technique and schedule logic shown in the AGC publication as described in 1.1B above. This consultant shall not have any financial or business ties to the Contractor, and shall not be an affiliate or subsidiary company of the Contractor, and shall not be employed by an affiliate or subsidiary company of the Contractor.

B. //(I) Prior to engaging a consultant, and within 10 calendar days after award of the contract, //(ii) With the initial cost proposal, the Contractor shall submit to the Contracting Officer:

1. The name and address of the proposed consultant.
2. Sufficient information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
3. A list of prior construction projects, along with selected activity on arrow (I-J) network samples on current projects which the proposed consultant has performed. These network samples must show complete project planning for a project of similar size and scope as covered under this contract.

C. The Contracting Officer has the right to approve or disapprove employment of the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of information. In case of disapproval, the Contractor shall submit another consultant within 10 calendar days for renewed consideration. The Contractor must have their CPM Consultant approved prior to //(I) submitting any diagram. //(ii) completion of contract negotiations. //]

### Basis for Payment

[COE: The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel shall result in an inability of the Contracting Officer to evaluate Contractor progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the

disapproval of the entire project schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where project schedule revision(s) have been directed by the Contracting Officer and those revision(s) have not been included in the project schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revision(s) to the project schedule have been made.]

[GSA: The Contractor shall be entitled to progress payment only upon approval of estimates as determined from the updated computer-produced calendar-dated schedule revised, submitted and approved for month of current invoice.

If the Contractor fails to submit the arrow diagram and computer-produced schedule within the time prescribed, or the updated monthly schedule within the time requested, the Contracting Officer may withhold approval of progress payment estimates until such time as the Contractor submits the required schedules. ]

[HHS: A. With the baseline Project Schedule submittal and each revision monthly update thereof, the Contractor shall also submit a schedule of cost loading, and cash flow to the Contracting Officer. There shall be a strict correlation between the sum of individual activity costs and the total values indicated for bid items and approved change orders.

B. Expected payment requests for each month shall be included with proposed updates. The cash flow reports shall show the net payment requests for each month.]

[NASA: If requested by the Contractor, the Government may make progress payments, provided that: A cost-loaded schedule is received, approved, and updated by the Contractor; other submittals are received in a timely manner; and logs and marked prints are properly maintained. The amount of any progress payment will be based on the agreed work status and the cost-loaded, updated schedule.]

[POST: The contractor is required to revise the progress schedule if, for any reason, it no longer reflects the actual progress and schedule. Revisions must be made to reflect the CO's authorized time extensions for contract modifications and other excusable delays. Progress payments from the contractor must not be accepted unless accompanied by an updated progress schedule.]

[STATE: Each monthly issue of schedule and report will serve as a basis for Project Director's evaluation of claims and requests for payment, contract modifications, extensions of time, and similar administrative decisions.]

[VA: (b) The Contractor shall submit a schedule of costs in accordance with the requirements of Section Network Analysis System (NAS) to the Contracting Officer for approval within 90 calendar days after date of receipt of notice to proceed. The approved cost schedule will be one of the bases for determining progress payments to the Contractor for work completed.

(1) Costs as shown on this schedule must be true costs and, should the Resident Engineer so desire, he/she may require the Contractor to submit his/her original estimate sheets or other information to substantiate the detailed makeup of the cost schedule.

(2) The total costs of all activities shall equal the contract price.

(3) Insurance and similar items shall be prorated and included in each activity cost of the critical path method (CPM) network.

(4) The CPM network shall include a separate cost loaded activity for adjusting and testing of the systems listed below.

(1) The Contracting Officer may retain funds: (I) Where performance under the contract has been determined to be deficient or the Contractor has performed in an unsatisfactory manner in the past; or (ii) As the contract nears completion, to ensure that deficiencies will be corrected and that completion is timely.

(2) Examples of deficient performance justifying a retention of funds include, but are not restricted to, the following: (I) Unsatisfactory progress as determined by the Contracting Officer; (ii) Failure either to meet schedules in Section Network Analysis System (NAS), or to process the Interim Arrow Diagram/Complete Project Arrow Diagram; (iii) Failure to present submittals in a timely manner; or (iv) Failure to comply in good faith with approved subcontracting plans, certifications or contract requirements.

(3) Any level of retention shall not exceed 10 percent either where there is determined to be unsatisfactory performance, or when the retainage is to ensure satisfactory completion. Retained amounts shall be paid promptly upon completion of all contract requirements, but nothing contained in this subparagraph shall be construed as limiting the Contracting Officer's right to withhold funds under other provisions of the contract or in accordance with the general law and regulations regarding the administration of Government contracts.

(5) Payment for adjust and test activities will be made only after the Contractor has demonstrated that each of the systems is substantially complete and operates as required by the contract.

#### Value of Adjusting, Correcting, and Testing

System:	System (percent)
Pneumatic tube system-----	10
Incinerators (medical waste and trash)-----	5
Sewage treatment plant equipment -----	5
Water treatment plant equipment -----	5
Washers (dish, cage, glass, etc.) -----	5
Sterilizing equipment -----	5
Water distilling equipment -----	5
Prefab temperature rooms (cold, constant temperature) ----	5
Entire air-conditioning system -----	5
Entire boiler plant system -----	5
Entire supply conveyors -----	10
Food service conveyors -----	10
Pneumatic soiled linen and trash system -----	10
Elevators and dumbwaiters -----	10
Materials transport system -----	10
Engine-generator system -----	5
Primary switchgear -----	5
Secondary switchgear -----	5
Fire alarm system -----	5
Nurse call system -----	5
Intercom system -----	5
Radio system -----	5
TV (entertainment) system -----	5

(6)(I) The contractor shall show on the critical path method (CPM) network the total cost of the guarantee period services in accordance with the guarantee period service section(s) of the specifications. This cost shall be priced out when submitting the CPM cost loaded network. The cost submitted shall be subject to the approval of the contracting officer. The activity of the CPM shall have money only and not activity time. (ii) The contractor shall submit with the CPM a guarantee period performance program which shall include an itemized accounting of the number of work hours required to perform the guarantee period service on each piece of equipment. The contractor shall also submit the established costs including employee fringe benefits

and what the contractor reasonably expects to pay over the guarantee period service, all of which will be subject to the contracting officer's approval. (iii) The cost of the guarantee period service shall be prorated on an annual basis and paid on equal monthly payments by Department of Veterans Affairs during the period of guarantee. In the event the installer does not perform satisfactorily during this period, all payments may be withheld and the contracting officer shall inform the contractor of the unsatisfactory performance allowing the contractor 10 days to correct and comply with the contract. The guarantee period service is subject to those provisions as set forth in the Payment and Default clauses.

(c) In addition to this cost schedule, the Contractor shall submit such unit costs as may be specifically requested. The unit costs shall be those used by the Contractor in preparing his/her bid and will not be binding as pertaining to any contract changes.

(d) The Contracting Officer will consider for monthly progress payments material and/or equipment procured by the Contractor and stored on the construction site as space is available, or at a local approved location off the site, under such terms and conditions as such officer approves, including but not limited to the following:

(1) The material or equipment is in accordance with the contract requirements and/or approved samples and shop drawings.

(2) Only those materials and/or equipment as are approved by the Resident Engineer for storage will be included.

(3) Such materials and/or equipment will be stored separately and will be readily available for inspection and inventory by the Resident Engineer.

(4) Such materials and/or equipment will be protected against weather, theft and other hazards and will not be subjected to deterioration.

(5) All of the other terms, provisions, conditions and covenants contained in the contract shall be and remain in full force and effect as therein provided.

(6) A supplemental agreement will be executed between the Government and the Contractor with the consent of the Contractor's surety for off-site storage.

(e) The Government reserves the right to withhold payment until samples, shop drawings, engineer's certificates, additional bonds, payrolls, weekly statements of compliance, proof of title, nondiscrimination compliance reports, or any other things



required by this contract, have been submitted to the satisfaction of the Contracting Officer.

(a) Contract work accomplished on the site by laborers, mechanics, and foremen/forewomen on the contractor's payroll and under his/her direct supervision shall be included in establishing the percent of work to be performed by the contractor. Cost of material and equipment installed by such labor may be included. The work by Contractor's executive, supervisory and clerical forces shall be excluded in establishing compliance with the requirements of this article.

(b) The contractor shall submit simultaneously with schedule of cost required by Payments Under Fixed-Price Construction Contract provision of the General Conditions of these specifications, a statement designating the branch or branches of contract work to be performed with his/her forces. The approved schedule of costs will be used in determining branch or branches, or portions thereof, of work for the purpose of this article.

(c) The contractor shall submit, simultaneously with the cost per activity of the construction schedule required by Section 01311, NETWORK ANALYSIS SYSTEM, a responsibility code for all activities of the network for which the contractor's forces will perform the work. The cost of these activities will be used in determining the portions of the total contract work to be executed by the contractor's forces for the purpose of this article (Jan. 21, 1988).

A. The Contractor shall cost load all work activities except procurement activities. The cumulative amount of all cost loaded work activities (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all activities for the entire project length. The VA will generate from this information cash flow curves indicating graphically the total percentage of activity dollar value scheduled to be in place on early finish, late finish, and 50 percent float dates. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. In the event of disapproval, the Contractor shall revise and submit in accordance with Articles, INTERIM ARROW DIAGRAM SUBMITTAL and THE COMPLETE ARROW DIAGRAM SUBMITTAL.

B. The Contractor shall cost load activities for guarantee period services, test, balance and adjust various systems in accordance with the provisions in the General Conditions, Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS (VA SUPPLEMENTAL CONDITIONS).

C. In accordance with Article PERFORMANCE OF WORK BY THE CONTRACTOR in the Section, GENERAL CONDITIONS, the Contractor shall submit, simultaneously with the cost per activity of the construction schedule required by this Section, a responsibility code for all activities (referred to as "branches" in the GENERAL CONDITIONS) of the network for which the Contractor's forces will perform the work.

//D. The Contractor shall cost load activities for ASBESTOS ABATEMENT. The sum of asbestos abatement activity costs shall equal the value of the asbestos bid item in the Contractors' bid.//

//E. The Contractor shall cost load activities for all BID ITEMS. The sum of the cost loading for each bid item activities shall equal the value of the item in the Contractors' bid.//

F. Activities for Contractor bond shall have a trade code and area code of BOND.

A. The monthly submission of the Department of Veterans Affairs "Look-Ahead Report" showing updated activities and cost data in accordance with the provisions of the following Payment and Progress Reporting is the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section GENERAL CONDITIONS. The Contractor is entitled to progress payment upon approval of estimates as determined from the currently approved updated computer-produced calendar-dated schedule unless, in special situation, the Contracting Officer permits an exception to this requirement.

B. When the Contractor fails or refuses to furnish the information and CPM Data, which, in the sole judgment of the Contracting Officer, is necessary for processing the computer-produced calendar-dated schedules, the Contractor shall not be deemed to have provided an estimate upon which progress payment may be made.]

[VOA: Note: Use either Option A or Option B.

A: If the ARCO determines that satisfactory progress was achieved during the update period, the ARCO shall authorize payment to be made in full for all activities completed during that period. However, if the ARCO determines that satisfactory progress has not been made, or that other specified conditions warrant, the ARCO may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved, and/or the other specified conditions warranting such action are met. The basis for determining progress payments shall be the cost values assigned to each activity in the Contractor's approved Interim and Target Schedules. Each

month's invoice shall be based on the most recent update of the Interim or Target Schedule. Payment shall be requested only for activities that were completed during the current update period, normally the current month, as included in the jointly annotated Update Report. Payments for partially completed activities will not normally be considered for approval. However, if partial payments are requested by the contractor and subsequently authorized by the ARCO, they shall be based upon the actual percentage of each activity completed as certified and approved by the ARCO during the update period. It must be emphasized that partial payments will only be considered for authorization in cases of financial hardship. All decisions regarding partial payments shall be made by the ARCO. Changes in the approved Interim or Target Schedules to subdivide and/or change activities in any fashion solely for the purposes of payment will not be approved. Payment requests may include material delivered both to the site and to other locations, e.g., the Contractor's manufacturing facilities, etc., provided the requirements of FAR clause 52.232-5, PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS are satisfied. Except for the premiums paid for performance and payment bonds, no payments will be made prior to the approval of the Contractor's Interim Schedule and subsequently the Contractor's Target Schedule. The Contractor's payment requests shall include a current Working Schedule. All other aspects of payments and/or billings are covered by Section G. (Note: Section G must also cross-reference back to this section.)

B: If the ARCO determines that satisfactory progress was achieved during the update period, the ARCO shall authorize payment to be made in full for all activities with progress shown during that period. However, if the ARCO determines that satisfactory progress has not been made, or that other specified conditions warrant, the ARCO may retain a maximum of 10 percent of the amount of the payment until satisfactory progress is achieved, and/or the other specified conditions warranting such action are met. The basis for determining progress payments shall be the percentage of work completed as shown in the Working Schedule and the dollar values assigned to each activity in the Contractor's approved, cost-loaded, Interim and Target Schedules. Each month's invoice shall be based on the most recent update of the Interim or Target Schedule. The amount of payment authorized each month shall be based upon the actual percentage of each activity completed during the update period as verified and approved by the ARCO on the jointly annotated Update Report. The resulting dollar value authorized for payment for each activity will be the result of applying the verified percentage of work completed for the activity against its total dollar value. Changes in the approved Interim or Target Schedules to subdivide and/or change activities in any fashion solely for the purposes of payment will not be approved. Payment requests may include material delivered both to the site and to other locations, e.g., the Contractor's manufacturing facilities, etc., provided the requirements of FAR clause 52.232-5, PAYMENTS UNDER FIXED-PRICE CON-

STRUCTION CONTRACTS, are satisfied. Except for the premiums paid for performance and payment bonds, no payments will be made prior to the approval of the Contractor's Interim Schedule and subsequently the Contractor's Target Schedule. The Contractor's payment requests shall include a current Working Schedule. All other aspects of payments and/or billings are covered by Section G.

(100K-1M) The basis for determining Progress Payments shall be the percentage of work completed as shown in the Working Schedule and dollar values assigned to each activity in the Contractor's approved Target Schedule. Each month's invoice shall be based on the most recent update of the Target Schedule. The amount of payment authorized each month shall be based upon the actual percentage of each activity completed during the update period as verified and approved by the ARCO on the jointly annotated Update Report. The resulting dollar value authorized for payment for each activity will be the result of applying the verified percentage of work completed for the activity during the update period against its total dollar value. Ten percent (10%) retainage may be withheld from all invoices if the ARCO determines that satisfactory progress is not being made on the contract.]

An estimate of the cost of each activity will be shown, which, when accumulated with the cost of all other activities in the network, shall equal the total contract amount. Overhead and profit shall be prorated over all activities. The total cost of an activity subset shall be equal to the cost of its associated task as identified in the Contractor's negotiated fee proposal.]

### **Data Disk Requirement**

[COE: The computer software system utilized by the Contractor to produce the project schedule shall be capable of providing all requirements of this specification and the data disk specified in Technical Provisions 01013, "Standard Data Exchange Format." Failure of the Contractor to meet the requirements of this specification and the data disk specified in Technical Provisions 01013, "Standard Data Exchange Format," shall result in the disapproval of the Contractor's schedule. Manual methods used to produce any information required in this section or the referenced Technical Provision shall require approval by the Contracting Officer.]

[STATE: As continued advances are made for the purpose of accomplishing scheduling and submittals requirements, the work of this section will probably specify machine-readable submittals for certain items, including microfiche and CADD; for product data, shop drawings, CPM schedules, various reports, listings, and similar items. This transformation can occur through normal, regular, updating procedures.]

[VA: A. The Department of Veterans Affairs will provide to the Contractor monthly computer processing of all computer-produced time/cost schedules and reports as a result of the monthly project updates. This computer service will include up to five copies of any five reports currently available on the VA CPM computer program. The VA will only provide computer processing and associated reports for the monthly project updates.

B. The VA will produce the five requested reports from the approved, cost loaded, interim arrow diagram or the complete project arrow diagram. The requested reports will be produced upon receipt of the completed Look-Ahead Report. The VA assumes responsibility for the correctness and timeliness of computer-produced reports. The Contractor is responsible for the accurate and timely submittal of the updated Look-Ahead Report and all CPM data necessary to produce the computer reports and payment request that is specified.

C. The Contractor shall report errors in computer-produced reports to the Contracting Officer's representative within seven calendar days from Contractor's receipt of reports. The Contracting Officer will reprocess the computer-produced reports to correct update errors only if the errors substantially affect the payment and schedule for the project.

D. Diskette Requirements and CPM Activity Record Specifications: Submit to the VA a 3-1/2" diskette(s) containing one file of the data required to produce an I-J computer-produced schedule, reflecting all the activities of the interim arrow diagram or complete project arrow diagram being submitted. Produce the file in the format specified and shown.

2. The file must consist of 80-byte, fixed length records only. The records may be in any sequence, since they will be sorted for VA CPM processing.

1. Work Activity Record:

<u>Pos.</u>	<u>Field Name</u>	<u>Data Requirements</u>
1-5	Blank	Fill with spaces
6	Contract Code	Alpha character if multiple contract; else a space
7-11	I Node	Numeric, right justify, left zero fill; not = 00000 or 99999
12-16	J Node	Numeric, right justify, left zero fill; not = 00000 or 99999
17-21	Blank	Fill with spaces
22-24	Duration	Numeric, right justify, left zero fill
25-29	Trade or Responsibility	Alpha-numeric, left justify, right space fill
30-34	Area	Alpha-numeric, left justify, right space fill

35-37	Blank	Fill with spaces
38-72	Description	Alpha-numeric, left justify, right space fill
73-79	Blank	Fill with spaces
80	Record Type Code	Insert character " 1 "

## 2. Activity Manpower Record (if Manpower > 0):

1-6	Blank	Fill with spaces
7-11	I Node	Numeric, right justify, left zero fill
12-16	J Node	Numeric, right justify, left zero fill
17-76	Blank	Fill with spaces
77-79	Manpower	Numeric, right justify, left zero fill
80	Record Type Code	

## 3. Activity Cost Record (if Cost > 0):

1-6	Blank	Fill with spaces
7-11	I Node	Numeric, right justify, left zero fill
12-16	J Node	Numeric, right justify, left zero fill
17-18	Blank	Fill with spaces
19-28	Cost Amount	Numeric [9(8)V99], right justify (allowing positions 27 and 28 for cents), left zero fill dollars and zero fill cents.
29-79	Blank	Fill with spaces.
80	Record Type Code	Insert character " 5 "

## 4. Restraint or Dummy Activity (not a Work Activity):

1-5	Blank	Fill with spaces
6	Contract Code	Alpha character if multiple contract; else a space
7-11	I Node	Numeric, right justify, left zero fill; not = 00000 or 99999
12-16	J Node	Numeric, right justify, left zero fill; not = 00000 or 99999
17-37	Blank	Fill with spaces
38	Restraint or Dummy	Insert character " < " (less than sign)
39-79	Blank	Fill with spaces
80	Record Type Code	insert character " 1 "]

**[VOA:** The Contractor shall submit Interim and Target Schedules in hard copy and on electronic media. The electronic media shall consist of one or more IBM DOS formatted, or equivalent, 3 ½" or 5 1/4" floppy diskettes. Data may be exported in one of the following s/w formats: Primavera, Suretrack, Lotus, or TT.]

## Use of the Critical Path Method

**[COE:** The Critical Path Method (CPM) of network calculation shall be used to generate the project schedule. The Contractor shall provide the project schedule in either the Precedence Diagram Method (PDM) or the Arrow Diagram Method (ADM) pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

**[GSA:** Develop a network plan demonstrating complete fulfillment of all contract requirements. Keep the network plan up-to-date in accordance with the requirements of this section and utilize the plan in planning, coordinating and performing the work under this contract (including all activities of subcontractors, equipment vendors and suppliers). I-J or Precedence technique may be utilized. ]

**[HHS:** The Contractor shall provide, operate, and maintain a computerized Project Schedule using the Critical Path Method (CPM) to plan and schedule the execution of the work, to assist the Contracting Officer in appraising the practicality of the schedule, to evaluate the progress of the work, to make progress payments, and to make decisions relative to time and/or cost adjustments which may result from changes in the work.

B. The Contractor shall use the construction scheduling principles and definitions of technical terms as contained in the 1976 publication of the Associated General Contractors of America (AGC) entitled, The Use of CPM in Construction, A Manual for General Contractors and the Construction Industry, (AGC Manual). In the case of any conflicts between the AGC Manual and the requirements of the Specification, the Specification shall govern.

A. The scheduling method to be used shall be a CPM schedule in the form of an activity on arrow network diagram (I-J format) or an activity on node network diagram (Precedence Diagram Method (PDM) format), at the Contractor's option, with capabilities of identifying the critical path. ]

**[NAVY:** Utilize conventional NAS (I-J) technique to satisfy both time and cost applications. The principles and definitions of the terms used herein shall be as set forth in AGCA UCPMC, along with COE ER-1-1-11, but the provisions of this section shall govern.

Numbering shall be assigned so that predecessor activity numbers (I-nodes) are smaller numerically than the successor activity numbers (J-nodes). Skip numbering shall be used on the network to allow insertion of additional activities for contract

modifications and logic changes. The minimum number of activities in the final network diagram shall be [      ]. Dummies and interdependencies are not counted as activities.]

**[STATE:** A. The Contractor shall develop a Network Analysis System (NAS) plan and schedule demonstrating fulfillment of the contract requirements, shall keep the network up to date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) (I-J) technique will be utilized to satisfy both time and cost applications.

B. Use the principles and definitions of the terms in the Associated General Contractors of America (AGC) publication, "The Use of CPM in Construction, A Manual for General Contractors and The Construction Industry," Copyright 1976, except the provisions specified in this section shall govern.

A. Critical Path Method (CPM): This procedure for scheduling and reporting project construction progress involves the networking of activities and events in optimum sequences, with control of time expenditures emphasized by a critical path through the network; and this usually involves electronic data processing, in order to analyze the available input data so as to organize and printout frequent reports of progress, in a meaningful and data-noted diagram, using a CPM EDP program. In addition to the following, refer to "The Use of CPM in Construction Industry," as published by AGC; comply with recommendations:

1. "Network" is a diagram of activities and events of the construction process, organized to show required sequences and relationships necessary to complete the construction work, within the Contract Time.

2. "Activity" is any one of the identifiable steps in performing the work of the Project (frequently a unit of work, as specified herein which cannot begin until certain other activities or units of work have been completed.

a. "Critical activity" is any activity which has no (zero) float time, and therefore is on the critical path; and constitutes one of the elements of work which establishes the minimum time required to complete Project work.

3. "Event" is either the starting or ending date of an activity.



4. "Float time" is the amount of time available for an activity in excess of the estimated duration for that activity; it represents the leeway available to schedule the activity. Contractor's proposed disposition of float time is, in every case, subject to acceptance by Project Director.

a. "Free float" is the amount of time an activity can be delayed without affecting the early start date of any subsequent activity.

b. "Total float" is the amount of time an activity can be delayed without affecting overall Project Time.

5. "Arrow diagram" is the computer-produced progress schedule, in the form of a network diagram, showing time expenditures and dates for activities and events completed prior to current date and scheduled for Contract Time remaining subsequent to current date. Together with required summary listings, schedules, and written narrative report, the updated arrow diagram (network diagram) comprise the monthly CPM progress report.

6. "Program" is the Critical Path Method (CPM) electronic data processing program, as utilized to initiate, update, and print out arrow diagrams, schedules, and summary listings, for monthly CPM progress reports. Except as otherwise indicated, computerized production of reports is required, utilizing a sophisticated CPM program, acceptable to Project Director.

1. Utilize the combination of a compatible and sufficiently capable CPM program; run on sophisticated electronic data processing (computer) equipment, which is accessible to the CPM operator of processing and return of outputs within 48 hours as maximum turn-around time; both in fulfillment of CPM scheduling requirements hereof. Submit a name and description of program, and a model number and location/owner of computer, to Project Director, for acceptance.]

### **Level of Detail Required**

[COE: With the exception of the preliminary schedule submission, the project schedule shall include an appropriate level of detail. Failure of the Contractor to develop or update the project schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the Contractor's schedule. The Contracting Officer shall use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the project schedule:]

**[HHS:** B. At the Preconstruction Scheduling Conference, the Contractor shall provide a work breakdown structure (WBS) for the Contracting Officer's approval which shall include the activity identification system for labeling all work activities, including material and equipment procurement, and the associated alphanumeric coding structure to implement the WBS. The WBS code fields shall be organized as follows:]

**[NASA:** The construction schedule shall include all significant design, submittal, fabrication, procurement and work activities; plus any constraints, outside of this contract which may impact work on the contract. Work activities longer than 10 working days shall be subdivided into phases/areas of work.

Cost-loaded construction schedule shall bear minimum separate activities for each roof area as follows: tear-off, re-roof, flashing and detailing.]

**[NAVY: NOTE:** A good knowledge of construction is required when determining the numbers of activities for a network analysis. Factors such as the nature of the work, geographical location, completion time, complexity ("the complexity of a project is related to the number of specification sections, the number of buildings, special phasing requirements and special quality control requirements"), cost of maintaining each activity throughout the life of the contract and level of use by field management personnel must be considered. As a general rule, use the following guidance:

PROJECT CONSTRUCTION COST	RECOMMENDED NUMBER OF ACTIVITIES
up to \$1,000,000	150 + activities
\$1,000,000 to \$2,000,000	150 to 200 activities
\$2,000,000 to \$5,000,000	200 to 1000 activities
\$5,000,000 to \$10,000,000	1000 to 2000 activities
over \$10,000,000	2500 + activities

When selecting the number of activities, please keep in mind the cost added to the contract. An activity needs to be maintained throughout the life of the contract and the use of too many activities will unnecessarily increase the total contract cost.

The guidance provided above is meant as GUIDANCE. Use your best judgment for selecting number of activities. Some contracts may require less number of activities than recommended amounts. (ex: A [800 km] [500 mile] contract to stripe a highway may have a project cost of \$6,000,000 but it should not require between 1000 to 2000 activities).]

**[POST:** The contractor must prepare and submit to the contracting officer for approval, and in accordance with Division I, a practical progress chart. The chart must show the principal categories of work, corresponding with those used in the breakdown on which progress payments are based, the order in which the contractor proposes to carry on the work, the date on which it will start each category of work, and the contemplated dates for completion.]

**[VA:** The Complete Project Arrow Diagram will contain, including dummies, approximately \_\_\_\_ activities.

6. Describe work activities clearly, so the work is readily identifiable for assessment of completion. Activities labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.

7. Uniquely number each activity with event numbers ranging from 1 to 99998 only. The diagram should be generally numbered in sequence; left to right; top to bottom, and omitting numbers ending in 3, 6, and 9 with J node always being greater than I node.]

**[VOA:** The Proposed Schedule shall contain all contract milestones listed in Section F and be sufficiently detailed to demonstrate that the Offerer fully understands the statement of work. The Proposed Schedule shall show all activities necessary to complete the work and an indication of the interrelationships with the activities of others.

The Contractor shall prepare a Work Breakdown Structure (WBS) for the work specified in this RFP. It shall be compatible with and provide the basis for the Proposed Schedule and the Contract Price shown in Section B, and it shall be submitted after contract award.

The WBS shall describe all of the work called for in the RFP. It shall be developed to the appropriate level of detail to properly describe how the Offerer proposes to perform the work.]

### ***Activity Durations***

**[COE:** Contractor submissions shall be required to follow the direction of the Contracting Officer regarding reasonable 9999 activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods. A rule of thumb, that the Contractor should use, is that less

than two percent (2%) all non-procurement activities' Original Durations shall be greater than 20 days. ]

[HHS: C. The activities included in the Project Schedule shall be analyzed in detail to determine activity time durations in units of project work days. Durations shall be based on the optimum labor, equipment, and materials required to perform each activity on a normal work day basis. No on-site activity shall have a duration over fifteen (15) work days except non-construction activities such as submittals, submittal reviews, procurement, and delivery of materials or equipment, and concrete curing. Only on-site construction activities will be shown as resource loaded to reflect cost, manpower, materials, and equipment, except for those off-site activities specifically approved by the Contracting Officer for cost loading. All cost loaded on-site activities shall be broken down into clearly identifiable work packages of \$20,000 or less per activity.]

[VA: B. Submit the following arrow diagram supporting data in addition to the arrow diagram, I -J schedule and 3-1/2" diskette(s). Failure of the Contractor to include this data will delay the review of the submittal until the Contracting Officer is in receipt of the missing data:

1. The proposed number of working days per week.
2. The holidays to be observed during the life of the contract (by day, month, and year).
3. The planned number of shifts per day.
4. The number of hours per shift.
5. The major construction equipment to be used on the site.
6. Break up the work into activities of a duration no longer than 20 work days each, except as to non-construction activities (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities for which the Contracting Officer may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals shall not be less than 20 work days. Refer to drawing CPM-1 for VA approval activities which will require minimum duration longer than 20 workdays. The construction time as determined by the CPM schedule from early start to late finish for any subphase, phase or the entire project shall not exceed the contract time(s) specified or shown. ]

**[VOA:** The number of activities with duration times less than 5 working days or in excess of 20 working days shall be kept to a minimum to facilitate monthly progress evaluation.]

### ***Procurement Activities***

**[COE:** Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over ninety (90) days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing.]

**[GSA:** Prepare the schedule in chronological order of submittals. Show category of the submittal, name of subcontractor, a generic description of work covered, related section numbers, the activity or event number on the progress schedule, the scheduled date for first submittal, resubmittal, and the final release or approval by the Contracting Officer.]

**[HHS: Procurement: 3.** The third code field shall identify the type of activity (types of activities shall be defined as "submittal", "Review", "Re-submittal", "review-approval", "procurement", "fabrication", "delivery", "construction/installation", "clean-up", "punch list", "testing", "training", or "change order");

4. All submittals, reviews, re-submittals, re-reviews, approvals, fabrication, and delivery of construction materials and major pieces of equipment purchased for the Contract; ]

**[VA: 3.** Show activities as:

a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.

b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.]

### ***Government Activities***

**[COE:** Government and other agencies activities that could impact progress shall be shown. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and notice to proceed for phasing requirements.]

**[HHS:** 5. All construction interface requirements involving government furnished equipment (GFE), including early and late delivery dates, provisions for storage and protection of GFE, and installation.

6. Preparation, submittal, review, re-submittal, re-review, and approval of shop drawings, as required by the Specifications, showing a twenty (20) day minimum review time for the Government's review on all normal or routine submittals and a thirty (30) day minimum review time for all major structural, electrical, or HVAC, plumbing and exterior finishes submittals;

7. Approvals required by regulatory agencies or other third parties;

10. Identification of interdependencies with preceding, concurrent, and follow-on contractors and utility companies as shown in the Contract Document, required tests, submission of test reports and approval of test results;

11. All start-up, testing, and training activities required under the Contract;

12. Punch list and final cleanup]

**[VA:** c. Interruption of VA Medical Center utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.

d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.

// e. VA inspection and acceptance activity with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity required by the contract phasing for that phase. Schedule these activities so that only one phase is scheduled for completion within the same 30 consecutive calendar day period (except for those phases immediately preceding the final acceptance). Maintain this scheduling condition throughout the length of the contract unless waived by the Contracting Officers representative in writing.//]

**[VOA:** The network diagrams shall include, but not be limited to, activities depicting the submittal and approval of the Contractor's Interim and Target Schedules, the procurement of all materials and equipment, preparatory and initial quality control inspections, the fabrication of material and equipment and subsequent installation, testing and commissioning, and all other contract milestones as listed in Section F.

The relationship to all activities of the Government and other contractors that affect progress.]

### ***Workers Per Day***

[COE: All activities shall have an estimate of the average number of workers per day that are expected to be used during the execution of the activity. If no workers are required for an activity, in the case of activities related to procurement, for example, then the activity shall be identified as using zero (0) workers per day. The workers per day information for each activity shall be identified by the Workers Per Day field pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[HHS: 13. Identification of any manpower, material or equipment restrictions, as well as any activity requiring unusual shift work, such as two (2) shifts per day, six (6) day work week, specified overtime, or work at times other than regular days or hours, shall be clearly identified in the Project Schedule

D. Critical or near critical paths resulting from the use of manpower or equipment restraints shall be kept to a minimum. Near critical paths shall be defined as those paths having ten (10) work days or less of total float.]

[NAVY: The information required by these items is optional and is seldom needed for routine work. It should only be specified on large and complex projects with critical completion dates. Manpower and equipment loading schedules are of primary importance to the Contractor in deciding the most efficient use of personnel resources and optimizing equipment usage. Since these decisions are the responsibility of the Contractor's management process, the information value to the Contracting Officer is in assuring that adequate manpower and equipment is being supplied throughout the course of the project.]

[VA: g. Manpower required (average number of men per day).]

### ***Responsibility***

[COE: All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[HHS: The fifth code field shall identify who is responsible to perform the activity (i.e., the Contractor, various subcontractors and suppliers, etc);

8. All subcontract work; ]

[NAVY: e. Responsibility code indicating the party responsible for accomplishment of the activity. As a minimum, provide a separate responsibility code for each subcontractor.]

[VA: c. Performance responsibility or trade code (five alpha characters or less): GEN, MECH, ELEC, CARP, PLAST, or other acceptable abbreviations.

// f. Work activities for the asbestos abatement bid item shall have a trade code of ASB.//

4. Show not only the activities for actual construction work for each trade category of the project, but also include trade dummies to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.]

### **Work Areas**

[COE: All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[GSA: Area Separations: Arrange the schedule to show each major area of construction of each major category or unit of work. Indicate where each major category of or unit of work must be sequenced or integrated with other work as necessary for structural completion, permanent space enclosure, and completion of mechanical and electrical work or completion of some other recognized stage of completion for overall work in that area. Except as otherwise indicated, or subsequently agreed upon with the Contracting Officer, a major area is defined for the purpose of this article to mean a story of construction or similar separation.]



[HHS: The fourth code field shall identify the area being worked in or the facility, if appropriate;

1. Physical breakdown of the project;
9. Access to and availability of work areas including all anticipated plant or utility shutdowns;]

[NAVY: f. Area code indicating the area of the project in which the work will be performed]

[VA: f. Work location or area code (five characters or less), descriptive of the area involved.]

#### ***Modification or Claim Number***

[COE: Any activity that is added or changed by contract modification or used to justify a claimed time shall be identified by the a mod or claim code that changed the activity. Activities shall not belong to more than one mod or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[HHS: All change orders shall be incorporated into the WBS by separate code fields.]

#### ***Bid Item***

[COE: All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[HHS: 1. The first code field shall designate the bid item as listed in the bid form;]

[VA: g. Bid items other than the Base Bid (ITEM 1) and Asbestos Abatement item shall have trade codes corresponding to the appropriate bid item number (e.g., ITM 3, ITM 4 and other items).]

**Phase of Work**

[COE: All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not be allowed to contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work code pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[HHS: 2. The second code field shall identify the construction phase, Contract milestone, or project element (if phasing of the work, Contract milestones, or project elements are identified in the Contract);]

[NAVY: Facilities with discrete completion dates shall be identified by separate sub-networks interconnected with the basic diagram.]

[VA: GENERAL: Work under this contract shall be divided into phased areas. The contractor shall perform the work in each phase in the sequence shown on the phasing plan (Drawing CPM-2). All work in each phase must be completed prior to VA occupancy of a phase and the start of work in a subsequent phase (except as noted). A detailed narrative description of each phase is as follows:

PHASE 1 (Main Public Entrance, New Water Line, Parking, Asbestos Abatement, and Covered Walkway): Upon the receipt of the Notice to Proceed and prior to the start of Phase 3, the contractor shall start and complete all contractual work involved in Phase 1 areas; including all temporary signage to direct traffic flow, main public entrance, parking, and asbestos abatement in the pipe basement, the installation of the new water line as noted on contract drawing No. 1-W-1 (item 5 of the general notes), and the covered walkway.

PHASE 2 (Chiller Building and Portion of the Site Work): Upon receipt of the Notice to Proceed, the contractor shall start and complete all contractual work involved in Phase 2 areas, including the chiller building, site utilities, roads, parking, walkways, and landscaping with the following construction restraints:

- a. This must be completed no later than the completion of Phase 3.
- b. Whenever excavation for any utility lines cross or run along existing roads, at least one lane must be kept open to traffic at all times.
- c. The new water line as noted on the contract drawing No. 1-W-1 shall be accomplished during Phase 1.

PHASE 3 (New Outpatient/clinical Addition): Upon completion of Phase 1 areas and prior to the start of Phase 4, the contractor shall start and complete all contractual work involved in Phase 3 with the following construction restraints:

a. The wall penetrations on the first and second floors of the existing Building 1, between Column Lines 11 and 12, shall be accomplished during this Phase 3.

b. The wall penetration on the second floor of the existing Building 1, east of Column Line 8, shall be accomplished during Phase 4.

c. The wall penetration on the second floor of the existing Building 1, west of Column Line 15, shall be accomplished during Phase 7.

d. The contractor shall provide temporary dust partitions (coordinate with Resident Engineer) on all of the above wall penetrations, to separate the construction areas from the VA occupied areas.

e. This work must be closely coordinated with the Phase 2 activities.

PHASE 4 (Pipe Basement, First and Second Floor East Wing): Upon completion of Phases 2 and 3, the VA will have fourteen (14) calendar days to move, then release Phase 4 areas to the contractor. The contractor shall then start and complete all contractual work involved in Phase 4.

PHASE 5 (Pipe Basement, First and Second Floor West Wing): Upon completion of Phase 4, the VA will have fourteen (14) calendar days to move, then release Phase 5 areas to the contractor. The contractor shall then start and complete all contractual work involved in Phase 5 areas.

#### SPECIAL PHASING REQUIREMENTS

a. Contractor shall construct dust partitions prior to the start of demolition and they must remain in place until the completion of that phase or subsequent phases where required.

b. Contractor shall perform all work in or adjacent to VA occupied areas in such a manner to ensure:

(1) The continuous and uninterrupted use of all occupied areas, including the applicable mechanical and electrical systems serving these areas.

(2) Protection of patients and personnel in occupied areas from the hazards and dust associated with a construction environment.

(3) The work areas are to be kept clear, clean, and free of loose debris, construction materials and partially installed work which would create a safe hazard or interfere with patient and personnel duties and traffic. The contractor shall sweep the areas clean at the end of each work day and make every effort to keep dust and noise to a minimum at all times.

c. Temporary interruptions or shutdown of any utility or electrical/mechanical system should be requested from the R/E 48 hours prior to the desired time, and should be performed at times other than the station's normal hours of operation or as directed by the R/E.

d. Two weeks (14 calendar days) prior to starting work in any phase, the contractor shall notify the R/E, in writing, of date he plans to complete the preceding phase. In no case will the contractor begin work in any phase without obtaining written approval from the R/E.

e. The sequence of work and durations as shown on the phasing diagram on Drawing CPM-are contractual and the contractor must complete all in each phase with the VA inspecting and accepting the work, prior to the contractor proceeding to the next scheduled phase.

G. Phasing: To insure such executions, Contractor shall furnish the Resident Engineer with a schedule of approximate //phasing// dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the Resident Engineer two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such //phasing// dates to insure accomplishment of this work in successive phases mutually agreeable to /medical Center Director, //Cemetery Director,// Resident Engineer and Contractor, as follows:

Phase I:

Phase II:

H. Building(s) No.(s) will be vacated by Government in accordance with above phasing beginning immediately after date of receipt of Notice to Proceed and turned over to Contractor.

H'. Building(s) No.(s) will be occupied during performance of work//. //; but immediate areas of alterations will be vacated.//

//1. Certain areas of Building(s) No.(s) will be occupied by Medical Center personnel for various periods as listed below: AREA PERIOD

Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.]

[VOA: The activity/milestone identifier shall be numeric and shall be consistent with Section F. The information shown on the network diagram for each activity shall be the same as that required for the Interim Schedule, with the felony exception;]

### ***Category of Work***

[COE: All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers to, but is not limited to, the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work code pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[GSA: D. Individual Work Stages: Show significant stages for each category or unit of work, including (where applicable), but not necessarily limited to, subcontract lettering, submittals, purchases, mockups, fabrication, sample testing, deliveries, installation, testing, adjusting, curing, start-up and placement into final use and operation.]

[HHS: 3. Type of work to be performed, the sequences, and the labor trades involved.]

### ***Feature of Work***

[COE: All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to a

work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work code pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

[FDA: The construction schedule shall be prepared in sufficient size and detail to clearly indicate: (1) The proposed sequence of construction including required phasing of the work and submissions of shop drawings, samples and other submittal information. This should include projected submittal approval dates and material delivery dates. (2) Percentages of the work in each category which is scheduled to be completed on a weekly basis.]

[HHS: 6. The sixth code field shall identify which Specification section the activity shall be performed under.]

### ***Equipment Schedule***

[NAVY: A description of the major items of construction equipment planned for operations of the project. The description shall include the type, number of units, and unit capacities. Provide a schedule showing proposed time equipment will be on the job keyed to activities on which equipment will be used.]

### ***Scheduled Project Completion***

[COE: The schedule interval shall extend from notice-to-proceed to the contract completion date that is specified in the clause entitled "COMMENCEMENT PROSECUTION AND COMPLETION OF WORK." ]

### ***Project Start Date***

[COE: The schedule shall start no earlier than the date that the Notice to Proceed (NTP) was acknowledged. [ The Contractor shall include as the first activity in the project schedule an activity called "Start Project." The "Start Project" activity shall have: a "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero (0) day duration pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format." ]

### ***Constraint of Last Activity***

[COE: Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float

calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project." The "End Project" activity shall have: a "LF" constraint, a constraint date equal to the completion date for the project, and a zero (0) day duration pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

**[CSB: Liquidated Damages:** The Owner will suffer financial loss if the Project and individual components are not substantially complete on the dates set forth in Exhibit D attached hereto. The Construction Manager (and the Construction Manager's Surety) shall be liable for and shall pay to the Owner the sums stipulated as fixed and agreed, liquidated damages for each calendar day of delay until the Work or relevant component is substantially complete, as such dates and calculation of such sums are set forth in Exhibit D annexed hereto and made a part hereof. It is further agreed that Construction Manager's liability for delay shall be based solely upon the liquidated damages exhibit (Exhibit D) irrespective of the commencement and completion dates set forth on the Project Schedule attached hereto as Exhibit B.]

### **Interim Completion Dates**

**[COE:** Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.]

**[HHS: 2.** Contract completion date and milestones, substantial completion dates, beneficial occupancy dates, phased occupancy dates, restraints of work shown in the Contract, and the final completion date;]

### ***Start Dates for Phases***

**[COE:** The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have: a "ES" constraint, a constraint date equal to the date that the NTP was acknowledged, and a zero (0) day duration pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

### ***End Dates for Phases***

**[COE:** The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have: a "LF" constraint, a constraint date equal to the completion date

for the project, and a zero (0) day duration pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

### ***Hammock Activities for Phases***

[COE: The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase. Hammock activities shall be identified pursuant to the requirements established in Technical Provision 01013, "Standard Data Exchange Format."]

### **Default Progress Data Disallowed**

[COE: Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates, and Remaining Durations on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in progress or completed activity and insure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.]

### **Out-of-Sequence Progress**

[COE: Activities that have posted progress without predecessors being completed (Out-of-Sequence Progress) shall be allowed only by the case-by-case approval of the Contracting Officer or authorized representative. The Contracting Officer's Representative may direct that changes in schedule logic be made to correct any or all out-of-sequence work.]

### **Extended Nonwork Period(s)**

[COE: Designation of Holidays to account for nonwork periods of over [ five (5) or XX days ] days shall not be allowed. Nonwork periods of over [ five (5) or XX days ] shall be identified by addition of activities that represent the delays. Modifications to the logic of the project schedule shall be made to link those activities that have may have been impacted by the delays to the newly added delay activities. ]



[NAVY: Identification of activities which are planned to be expedited by use of overtime or double shifts to be worked, including Saturdays, Sundays and holidays including dates of notification.]

### **Negative Lag(s)**

[COE: Lag durations contained in the project schedule shall not have a negative value.]

### **Project Schedule Submissions**

[COE: The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph "Submission Requirements."]

[HHS: The Contractor shall be required to submit an updated schedule at the time the government chooses to exercise any of the project options. The cost of revising the schedule shall be included in the project option cost.]

#### ***Proposed Schedule***

[VOA: The Proposed Schedule showing the general approach to performing the specified work shall be submitted with the Offerers proposal. This schedule shall be a precedence network and shall include the following information for each activity:

Description;  
Early and late start and finish dates;  
Duration of each activity in working days; and  
Responsibility for executing the activity;]

#### ***Preliminary Project Schedule Submission***

[COE: The Preliminary project schedule, defining the Contractors planned operations for the first [ sixty (60) or XX calendar days ] shall be submitted for approval within [ twenty (20) or XX calendar days ] after Notice To Proceed is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed [ sixty (60) or XX calendar days ] after Notice To Proceed. ]

**[FDA:** Within ten (10) calendar days of receipt of a Notice to Proceed, the Contractor shall submit to the Contracting Officer a proposed construction schedule for review and approval by the Government. The construction schedule shall be approved in writing before any site work is started. The schedule shall be prepared in bar graph form following the outline of the component divisions and subsections of the project specifications. ]

**[GSA:** Submit construction progress schedule within X calendar days after Notice to Proceed is received. Immediately after the development and acceptance of the fully developed progress schedule, prepare a complete schedule of work-related submittals. Submit this schedule within 10 days of the date required or establishment of progress schedule.

Within 20 calendar days after receipt of notice to proceed, provide a summary time scaled network diagram for the project. Include a detailed network description including the data required in 'COMPUTER-PRODUCED SCHEDULE REQUIREMENTS' below, for the first 120 calendar days of operation. Show the critical path graphically on the summary network.]

**[HHS: PRECONSTRUCTION SCHEDULING CONFERENCE:** Within fourteen (14) calendar days after Contractor's receipt of the Notice to Proceed, the Contracting Officer will schedule and conduct a preconstruction Scheduling Conference with the Contractor's Project Manager and Construction Scheduler to commence development of the required Project Schedule. At this meeting, the requirements of this Specification section will be reviewed with the Contractor. The Contractor shall be prepared to review and discuss the methodology for preparing the schedule, as well as his planned sequence of operations and resource and cost loading of the schedule.

## 2.05 COMMENTS BY THE CONTRACTING OFFICER:

A. Comments made by the Contracting Officer on the Project Schedule during review shall not relieve the Contractor from compliance with the requirements of the Contract Documents.

B. Following the Contractor's receipt of the Contracting Officer's review comments, the Contractor shall review the schedule to identify missing activities and relationships relevant to the scope of the work, no time extensions will be granted by the Contracting Officer to complete activities not initially included in the Contractor's Project Schedule.

C. To the extent that there are any conflicts between the approved Project Schedule and the requirements of the Contract Documents, the Contract Documents shall govern.

## 2.06 RE-SUBMITTAL OF THE PROJECT SCHEDULE FOLLOWING DISAPPROVAL

Should the Contracting Officer disapprove the Contractor's submission of the Project Schedule, the Contractor shall comply with the Contracting Officer's direction and submit the Project Schedule and all associated submittals within seven (7) calendar days.]

### [NAVY:

#### 1.6.1 Preliminary Meeting

If requested by the Contracting Officer, participate in a preliminary meeting to discuss the proposed schedule and requirements of this section prior to submission of the network.

#### 1.6.2 [Preliminary Network]

[NOTE: This paragraph should only be used on complex contracts.] Submit a preliminary network defining the planned operations during the first [90] [ ] calendar days after contract award within [20] [ ] days. The general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the whole schedule should be included. Submit three copies of both the preliminary network diagrams and required sorts listed in paragraph entitled, "Required Sorts." In accordance with paragraph entitled, "Monthly Reports," the preliminary network may be used for requesting progress payments for a period not to exceed 90 calendar days after receipt of "Contract Award." Payment requests after the first 90 calendar day period shall be based upon the complete network.]]

[STATE: A. Initial Progress Schedule: In compliance with CC&C; prepare and submit within 14 days of Government's "Notice to Proceed," an initial general progress schedule as proposed for the time-scheduling of major elements of the entire Project, including work by separate contractors and Governments, and which is within or overlaps time scheduled for this Construction Contract. Provide single sheet, bar-chart type, time/work charting format; with time charted horizontally and work listed vertically; do not exceed 33 x 25.5 inch (838 x 648 mm) overall chart size.

Concentrate initial scheduling effort upon the true identification of scheduling interfacing-and-sequencing requirements which may constitute the critical path of time expenditures likely for administering/coordinating/performing work of Project; omit work which, obviously, does not have a controlling effect upon total time for construction work. Concentrate upon unique administrative requirements of Project circumstance; including start-up, phasing, security, foreign location, and similar time-consuming elements.

1. Prepare separate detailed schedule for first 60 days of Contract Time, concentrating upon the required activities of an expedited Project start-up; including submittals, permits, temporary facilities, and similar items as necessary for a successful start of work at Project Site. Prepare as a single sheet, not exceeding specified overall chart size. List related work in a logical sequence, so that logic of the schedule is apparent. Highlight critical dates for approvals, deliveries, receipt of permits, and similar times/events which are most likely to form the critical path of work during the first 60 days. Arrange chart for convenience of daily/weekly markup of actual progress, in support of initial payment requests and similar needs for initial administration/supervision of work. Show how start-up of work on this Contract, including related work by separate contractors and by Government, interfaces with work of preceding contracts and with existing work/conditions at Project Site.

2. During first 60 days of monitoring job progress, mark up copies of both the initial progress schedule and 60-day detail schedule, to show actual job progress. Prepare markups during 7-day period prior to each coordination meeting, and reissue/distribute/post schedules promptly after each meeting.]

[VA: Within 21 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review, five blue line copies of an Interim Arrow Diagram on sheets of paper 30 inches by 42 inches, a 3-1/2" diskette(s), and five copies of a computer-produced I-J schedule. The I-J computer-produced schedule shall meet all contractual requirements such as contract duration, phases and phasing restraints. The Interim Arrow Diagram shall cover the following project phases and activities:

1. Procurement -Submittals, approvals, fabrication and delivery of all key and long lead time procurement activities.

- //2. The activities to be accomplished during the first 120 work days of the project and shall include the following phases or subphases.

3. Summary activities which are necessary (not included under the paragraph above) to properly show:

a. The approach to scheduling the remaining work areas or phases of the project. The work for each phase or area must be represented by at least one (summary) activity so that the work cumulatively shows the entire project schedule.

b. Approximate cost and duration for each summary activity which is the Contractor's best estimate for all the work represented.

c. Realistic delivery dates for all procurement activities required and specified.

d. Summary activities shall have a trade code of SUM.

4. In addition to the Interim Arrow Diagram, the Contractor shall submit five copies of a computer-produced I-J schedule showing project duration; phase completion dates; all dummies; and other data, and activity cost. Each activity on the computer-produced schedule shall contain as a minimum, but not limited to, I-J nodes, duration, trade code, area code, description, budget amount, early start date, early finish date, late start date, late finish date and total float. The Contractor shall submit a 3-1/2" diskette(s) for the Interim Diagram submission, as specified under Article ARROW DIAGRAM REQUIREMENTS, paragraph DISKETTE REQUIREMENTS AND CPM ACTIVITY RECORD SPECIFICATIONS.

B. The Interim Diagram shall describe the activities to be accomplished and their inter dependencies subject to all requirements specified, where appropriate. All work activities, other than procurement activities, shall be cost loaded as specified and are the basis for partial payment during the beginning months of the contract, while the complete working arrow diagram is being developed and approved. Interim diagram shall not be used for time extension analysis. All CPM data supporting any time extension request, in accordance with Article ADJUSTMENT OF CONTRACT COMPLETION, will be derived from the approved final arrow diagram.

C. Within 21 calendar days of receipt by the Contracting Officer of the Interim Arrow Diagram, the Contracting Officer shall notify the Contractor concerning approval or disapproval of the Interim Arrow Diagram. In the event of disapproval, the Contractor shall submit, within 14 calendar days, five blue line copies of the revised arrow diagram, five copies of the revised computer produced I-J schedule and a revised 3-1/2" diskette in accordance with any agreements reached as a result of the Contracting Officer's review.]

[VOA: The Contractor shall prepare an Interim Schedule showing the general approach to be used in performing the specified work during the first 90 calendar days after the award of contract. This schedule is subject to approval by the ARCO, it shall be a precedence network, submitted in both tabular and graphical formats, and shall include the following information for each activity:

Description;

Early and late start and finish dates;

Duration of each activity in working days, considering the scope of the work involved in the activity and the resources planned for the accomplishment of the activity plus any time required for environmental factors;

Responsibility for executing each activity; and

Estimated cost of each activity, which, when accumulated with the cost of all other activities in the remainder of the network, shall equal the total contract amount to be expended over the first 90 calendar days. Overhead and profit for the activities shown shall be prorated amongst those activities. The total cost of an activity subset shall be equal to the cost of its associated task as identified in the Contractor's negotiated fee proposal.

The Interim Schedule shall contain all contract milestones listed in Section F that occur in the first 90 calendar days, show all activities necessary to complete the work, and indicate the interrelationships with the activities of others.

Within 10 calendar days after Notice to Proceed (NTP) the Contractor shall submit an Interim Schedule covering the first 90 calendar days after NTP.

The Contractor's Interim Schedule, Work Breakdown Structure, and Target Schedules shall be reviewed by the ARCO in a meeting with a representative of the Contractor within 15 calendar days after submittal.

Within 10 calendar days thereafter, the Contractor shall revise and submit the Interim Schedule, Work Breakdown Structure, and Target Schedule as required by the ARCO. The revised Interim Schedule, Work Breakdown Structure and Target Schedules shall be approved or rejected by the ARCO within 10 calendar days after receipt. The approved Interim Schedule, Work Breakdown Structure, Target Schedules and monthly updates, i.e., the Monthly Working Schedule, shall be used by the Contractor for planning, organizing and directing its work and reporting progress.]

***Initial Project Schedule Submission***

[COE: The Initial project schedule shall be submitted for approval within [ forty (40) or XX calendar days ] after Notice To Proceed. It shall provide a reasonable sequence of activities which represent work through the entire project and a reasonable level of detail.]

[GSA: Within 90 calendar days after receipt of notice to proceed, submit for the Contracting Officer's review and approval arrow diagram of the complete project schedule describing the activities to be accomplished and their dependency relationships, together with a computer-produced schedule in accordance with the requirements of Article, 'COMPUTER PRODUCED SCHEDULE REQUIREMENTS,' showing starting dates for each activity in terms of the number of days after receipt of notice to proceed. All completion dates shown shall be within the period specified for contract completion.

Within ten calendar days after receipt of the initial arrow diagram the Contracting Officer will meet with the Contractor for joint review, correction, or adjustment of the proposed plan and schedule. Within five calendar days after the joint review, revise the arrow diagram in accordance with agreements reached during the joint review and submit two copies of the revised arrow diagram and to the Contracting Officer. The submission will be reviewed by the Contracting Officer and, if found to be adequate, will be approved; an approved copy of each will be returned to the Contractor. After the Contractor has received both the notice to proceed and the approved copy of the arrow diagram, he shall immediately substitute calendar dates on the network diagram in lieu of the number of days from date of notice to proceed and shall furnish three copies of the arrow diagram as revised to the Contracting Officer. The arrow diagram, as approved by the Contracting Officer, shall constitute the project work schedule until subsequently revised in accordance with the requirements of this section.]

[HHS: A. Seven (7) calendar days after the Preconstruction Scheduling Conference, the Contracting Officer shall meet with the Contractor to receive an update on the progress in the development of the Project Schedule. Within fourteen (14) calendar days after the Preconstruction Scheduling Conference the contractor shall submit the baseline Project Schedule (i.e., with a date equal to the date of Contractor's receipt of the Notice to Proceed), the Cash Flow Projection, and the Manpower Requirements Forecast to the Contracting Officer.

B. The Project Schedules shall show the sequence and interdependence of activities required for complete performance of the work, beginning with Contractor's

receipt of the Notice to Proceed and concluding with the date of Final Completion of the Contract. The Project Schedule shall show all activities in work days, with allowance for Government holidays and the effects of normal weather conditions on outside work.

C. The Project Schedule shall incorporate all WBS code information and shall identify the cost to perform each work activity requiring a cost expenditure. The sum of the costs assigned to all activities shall equal the Contract value. No activity costs shall be assigned to submittals or submittal reviews. The accepted cost loaded Project Schedule shall constitute the Schedule of Values from which monthly progress payments will be made in accordance with the provisions in the Contract for partial payments.

D. The Project Schedule shall comply with all limits imposed by the scope of work, with all contractually specified intermediate milestones and completion dates, and with all constraints, restraints, or sequences included in the Contract.

E. Schedule revisions shall be required at the Contractor's expense at the time the government elects to exercise any of the project options.

A. The Project Schedule network and computer tabulations, the Cash Flow Projection, the Manpower Requirements Forecast, and the written confirmation from subcontractors and suppliers shall be submitted to the Contracting Officer for approval in six (6) copies (8-1/2" x 11" in size). Additionally, the Contractor shall submit two (2) copies of the P3 data on 3.5" DS, HD computer diskettes, compatible with the Government's schedule monitoring hardware, containing the resource and cost loaded Project Schedule data.

B. The Contracting Officer shall approve or disapprove, in writing, the Contractor's submission of the Project Schedule and associated submittals within fourteen (14) calendar days after receipt of all required information. If the Project Schedule is disapproved, the Contracting Officer shall provide comments in writing to the Contractor stating the reasons why the submittal was disapproved.

**3.05 CONSTRUCTION EQUIPMENT REPORT.** The Contractor shall submit with the baseline Project Schedule submittal and each revision or monthly update thereof a Construction Equipment Report of each major piece of construction equipment planned for use on the project, and the calendar dates that the equipment is expected to be on-site. The Construction Equipment Report shall be computer generated from the Contractor's resource loaded Project Schedule. Each major piece of the



Contractor's and the subcontractor's equipment shall be separately described, identified, and numbered in the report.]

[NASA: (a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.]

[NAVY:

1.6.3 Completed Network

Submit the complete network analysis, consisting of the network mathematical analysis and network diagrams, within 40 calendar days after contract award. Submit three copies of both the diagrams described in paragraph entitled, "Diagrams" and required sorts listed in paragraph entitled, "Required Sorts."

1.6.4 Review and Evaluation

The Contractor shall participate in a review and evaluation of the proposed network diagrams and analysis by the Contracting Officer. Revisions necessary as a result of this review shall be resubmitted for approval of the Contracting Officer within 10 calendar days after the conference. The approved schedule shall then be the schedule to be used by the Contractor for planning, organizing, and directing the work, reporting progress, and requesting payment for work accomplished.

1.6.6 Approved Network

Once the completed network has been approved by the Contracting Officer, the Contractor shall within 15 calendar days furnish:

- a. One mylar or equivalent of the network diagrams
- b. Three copies of the network diagrams
- c. Three copies of the required sorts listed in paragraph entitled, "Required Sorts"

- d. Three copies of the I-J (Look-Ahead Report) specified in paragraph entitled, "Monthly Reports"
- e. Three copies of the Cash Flow Report indicating the cash flow based upon both the early and late start schedules.

For major revisions or changes to the network diagrams, once approved by the Contracting Officer, the Contractor shall submit these same diagrams and reports except submit the cash flow report only after the original complete network has been approved.]

[STATE: 1. Initial Arrow Diagram: Prepare and submit initial arrow diagram of CPM procedure, to concentrate upon detail requirements for the activities which have starting dates in the first 120 days of Contract Time; with remaining activities shown skeletally to complete the critical path, as recognized at time of this submittal; show critical path graphically on the summary network. Comply, generally, with requirements indicated below for detailed reporting, including supporting data. Meet with Project Director within 10 days of submittal, for review, corrections, and adjustments to the initial arrow diagram and supporting data. Resubmit corrected diagram and data within 5 days of meeting; this submittal will be recognized as the initial Progress Report; distribute to Project Director and each entity of the project involved or affected by the committed activities and events, and post arrow diagram, as requested by Project Director, at Project Site for the information of everyone concerned.]

[VOA: The Contractor shall prepare a Target Schedule, which shall be reviewed and approved by the ARCO. The initial Target Schedule shall include all work included in the initial contract award. Thereafter, additional Target Schedules will only be submitted as additional contract options, if any, are exercised or if changes are requested by the Contractor or directed by the internment.

Each Target Schedule shall be submitted in both tabular and graphical formats. The same information is required for each activity in the Target Schedule as is required in the Interim Schedule discussed above. The graphical format shall consist of a network diagrammed in precedence format. In preparing the network schedule, the scheduling of all work included in the contract shall be the responsibility of the Contractor.

The Target Schedules shall be consistent with the WBS and shall indicate an orderly work flow. Upon approval by the ARCO, the initial Target Schedule and subsequent Target Schedules will collectively become the approved Target.

The Contractor shall be required to conform to the approved Target Schedule for the remainder of the project. However, the requirement to follow the approved Target

Schedule shall not inhibit the contractor from starting activities as soon as possible except when the early start of an activity is constrained by the completion of an activity by the Government or another contractor. In such cases an earlier start must be approved by the ARCO.

Within 60 calendar days after contract award, the Contractor shall submit the Work Breakdown Structure for all of the work specified in the contract and the initial Target Schedule for the work under contract. Thereafter, the Contractor shall submit, within 30 calendar days after any option is exercised, the Target Schedule for the work included in the option. The Contractor shall resubmit, within 10 calendar days after receipt of the ARCO's review, the corrected schedules, network diagrams, and Work Breakdown Structure.]

### ***Periodic Schedule Updates***

[COE: Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer or authorized representative to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative, is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.]

[CSB: Updated Schedules 3.9.3 Keep accurate and detailed written records of the progress of the Project during all stages of construction; submit monthly written progress reports to the Owner including, but not limited to, information concerning the Work of each of the separate contractors, the percentage of completion and the number and amount of change orders. Maintain a daily detailed log of all events occurring on the job site(s) or connected with progress of the Project. The log shall be open to the Owner and the Architect at all times and shall be turned over to the owner at the completion of the Work.

Maintain copies of the Progress Schedule at the job site(s) to reflect current conditions and provide copies to the Owner with periodic reports as to deviations from the Schedule, the causes of the deviations, and the corrective action taken.]

[FDA: An updated construction schedule shall be submitted each month so the work proceeds, with the request for partial payment where applicable. Update shall reflect the expected and actual impact of change in the work vs. the projected status. The

updated schedule shall also reflect the changes in the future portion of the schedule necessary to finish the project within the contract completion time. ]

**[GSA:** Once each month, prepare and submit to the Contracting Officer a revised arrow diagram showing all changes in network logic, including but not limited to changes in activity duration, and revised activity cost estimates as the result of contract modifications, changes in activity sequence and any changes in contract completion dates which have been approved within this section since the last revision of the arrow diagram. Revisions causing changes in the detailed network shall be noted on the summary network, or a revised issue of affected portions of the detailed network furnished. Revise the summary network as necessary for the sake of clarity. However, only the initial submission or completed revisions need be time scaled. Subsequent revision need not be time scaled.

B. Once each month, prior to the date specified by the Contracting Officer for submission of updated computer-produced calendar-dated schedule, make entries on the preceding computer-produced calendar-dated schedule: 1. Show actual progress and percent completed of those activities in progress; 2. identify those activities started and those completed during the previous period; 3. Show the estimated time required to complete each activity stated but not yet completed; 4. Reflect any changes in the arrow diagram.]

**[HHS:** A. If the Contractor fails to submit the Project Schedule network diagrams and computer tabulations, the cash flow projections, the manpower forecasts, written confirmation of subcontractors and suppliers, or computer diskettes within the time prescribed, the Contracting Officer may stop the Contractor's work at no additional cost to the Government. Further, the Contractor shall not be permitted to mobilize on-site and no mobilization progress payments shall be made until such time as the Contractor submits the required information and obtains approval of the baseline Project Schedule. Approval of the baseline Project Schedule is a condition precedent to payment of any portion of the Contract amount.

B. Failure of the Contractor to submit the Project Schedule or any required re-submittals or updates in a timely, accurate manner, and in accordance with the requirements of this Specification section, will result in costs to the Government that are difficult if not impossible to determine. Therefore, the Contractor shall pay the Government liquidated damages in the amount of \$500.00 per work day, for every work day that the schedule submittal, revision, re-submittal, or update is late. This amount shall be subtracted from any moneys due and shall be forfeited by the Contractor.]

The following computer generated reports in hard copy and on computer diskettes shall be required as apart of the baseline Project Schedule submittal and each revision or monthly update thereof as a condition precedent to the receipt of progress payments under the Contract:

1. Earned Value Report, in tabular format, sorted by organizational responsibility, including cumulative earnings for each activity, for the Contractor, each subcontractor and supplier, and for the entire project.

2. Net and Cumulative Cash Flow Earnings and Projection, in histogram and tabular formats, for the entire project.

- A. The Contractor shall prepare a manpower analysis in the form of a series of graphic displays and tabular reports depicting manpower by principle trade and total manpower for the project. The manpower analysis shall be computer generated from the Contractor's resource loaded Project Schedule

- B. The following computer generated reports in hard copy and on computer diskettes shall be required as part of the baseline Project Schedule submittal and each revision or monthly update thereof as a condition precedent to the receipt of progress payments under the Contract:

1. Net and Cumulative Trade Manpower Requirements Forecast by month, in histogram and tabular formats, for the entire project;

2. Net and Cumulative Total Manpower requirements Forecast by month, in histogram and tabular formats, for the entire project.

- B. Following the approval of the initial Construction Equipment Report, the Contractor shall update the report each month to show any changes in the planned use of major construction equipment. In a separate monthly listing to be provided to the Contracting Officer (which need not be computer generated from the Project Schedule), the Contractor shall record the actual dates that major construction equipment arrived and was removed from the site.]

**[NASA:** (b) The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circum-

stance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained. (c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be (end of paragraph)

The Contractor shall submit monthly progress reports to the Contracting Officer, along with the latest updated schedule and any progress payment request. The report shall address: Progress made during the period; Comments on activities which are behind schedule, including reasons, the impact on the overall schedule, and mitigating actions taken or planned discussion of any current or anticipated problems, technical or scheduling; and other appropriate comments.

Update the schedule in one reproducible and two copies at least monthly, in coordination with the Contracting Officer.]

**[NAVY:** Submit at monthly intervals a report of the actual construction progress by updating the required sorts and the time scaled logic diagram. Initially, and monthly thereafter, produce a projected report of scheduled activities to be started, in process or completed during the upcoming reporting period, sorted by early start then I-J (Look-Ahead Report). At the end of the reporting period, Contractor and Government representatives shall jointly make entries on the preceding Look-Ahead Report to show actual progress. As a minimum, the following action will be accomplished:

- a. Identify activities started and completed during the previous period
- b. Show estimated duration (in work days) to complete each activity started but not completed during the previous period
- c. Show estimated duration (in work days) to complete each activity started but not completed
- d. Indicate percentage of cost payable for each activity
- e. Reflect changes in the network diagram.]

**[POST:** The chart must be in suitable scale to indicate graphically the total percentage of work scheduled to be in place at any time. At the end of each progress payment period, or at such intervals as directed by the contracting officer, the contractor must:

1. Adjust the chart to reflect any changes in the contract work, completion time, or both, as approved by the contracting officer;
2. Enter on the chart the total percentage of work actually in place; and
3. Submit three copies of the adjusted chart to the contracting officer. ]

**[STATE:** 2. Updated Progress Reports: Within 30 (calendar) days of distributing/posting of initial arrow diagram and supporting data, and on same day of each succeeding month of Contract Time; produce, submit, and post updated CPM progress report. Show full detail information on every prime activity and unit-of-work for the complete Project; byway of record for completed work, and as scheduled work for current and yet-to-start activities. Break up units of work, which require more than 15 working days, into segregate activities relevant to performance; e.g., "...Placing Concrete, 3rd Story..."; comply with Project Director's requests. Include crucial dates for events which precede actual installation activity in each case, including (as examples) shop drawing submittal/approval, fabrication, deliveries to Project Site, and coordination drawings. Exercise the highest priority for determination effort on the forthcoming 4 months of activities on the critical path; with second highest effort on both the forthcoming 4 months of activities off the critical path, and 3 additional months of activities on the critical path. Show the necessary logic for recognition of the interdependence of each activity upon other activities. Show activity time duration, which is consistent with contracted commitment, for each entity performing work; or show best estimate of time, where commitment is not yet secured. Continue updating/adjusting/correcting-of-logic for diagram and supporting data; both as record prior to current date, and as projections of the schedule for work to be performed; and include, each month, the effect (if any) of Contract Modifications. Except as otherwise directed, distribute each monthly issue of CPM schedule one calendar week in advance of scheduled monthly coordination meeting; see Section 01041 "Project Coordination" hereof. Project Director's review, requests for adjustment of, and acceptance of each issue of CPM schedule, will not relieve Contractor of responsibility for errors and omissions therefrom.]

[VA: A. Within 30 calendar days after receipt of any computer-produced schedule, the Contractor will submit a revised arrow diagram and a (I-J) list of any activity changes for any of the following reasons:

1. Delay in completion of any activity or group of activities, indicate an extension of the project completion by 20 working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.

2. Delays in submittals, or deliveries, or work stoppage are encountered which make replanning or rescheduling of the work necessary.

3. The schedule does not represent the actual prosecution and progress of the project.

4. Activity costs are revised as the result of contract modifications.

B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Medical Center, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, must be furnished in writing to the Contracting Officer for approval.

C. Contracting Officer's approval for the revised arrow diagram and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

D. The cost of revisions to the arrow diagram resulting from contract changes will be included in the proposal for changes in work as specified in Article, CHANGES of the GENERAL CONDITIONS, and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.

E. The cost of revisions to the arrow diagram not resulting from contract changes is the responsibility of the Contractor.]

[VOA: Once the Initial Target Schedule has been developed by the Contractor and approved by the ARCO the Contractor shall create a Monthly Working Schedule. This Working Schedule is based on the approved Target Schedule with monthly updates



incorporated. The Working Schedule, derived from the Target Schedule and its subsequent monthly updates, which the Contractor shall prepare for the duration of the contract, shall be used by the Government to monitor the Contractor's schedule performance against the Target Schedule and be the basis for all billings in accordance with H.1.2.9, "Progress Payments", below. Prior to approval of the Target Schedule, the approved Interim Schedule shall be updated monthly.

The Contractor's Interim Schedule, Work Breakdown Structure, and Target Schedules shall be reviewed by the ARCO in a meeting with a representative of the Contractor within 15 calendar days after submittal.

Within 10 calendar days thereafter, the Contractor shall revise and resubmit the Interim Schedule, Work Breakdown Structure, and Target Schedule as required by the ARCO. The revised Interim Schedule, Work Breakdown Structure and Target Schedules shall be approved or rejected by the ARCO within 10 calendar days after receipt. The approved Interim Schedule, Work Breakdown Structure, Target Schedules and monthly updates, i.e., the Monthly Working Schedule, shall be used by the Contractor for planning, organizing and directing its work and reporting progress.]

#### ***Standard Activity Coding Dictionary***

[COE: The Contractor shall submit, with the initial project schedule, a coding scheme that shall be used throughout the project for all activity codes contained in the schedule. The coding scheme submitted shall list the values for each activity code category and translate those values into project specific designations. For example, a Responsibility Code value, "ELE", may be identified as "Electrical Subcontractor." Activity code values shall represent the same information throughout the duration of the contract. Once approved with the initial project schedule submission, changes to the activity coding scheme must be approved by the Contracting Officer or authorized representative. ]

#### ***Data Disks***

[COE: [ Three (3) or XX ] data disks containing the project schedule shall be provided. Data on the disks shall meet Technical Provision 01013, "Standard Data Exchange Format."]

[NAVY: The Contractor is required to provide [IBM-compatible (IBM is a registered trademark of International Business Machines) data diskettes, 130 mm 5.25 inch) double sided, double density floppy disks, PC-DOS Version 2.0 or greater,] [a Microsoft project for windows] [a Microsoft project for Macintosh] of all required network

analysis submissions and updates in addition to the specified number of hard copies of reports and network diagrams.]

### ***File Medium***

[COE: All required data shall be submitted on [ 3.5" or XX ] disk(s), formatted to hold [ 1.44 MB or XX ] of data, under the [ MS-DOS or XX ] [ Version 5.0 or XX ] operating system.]

[VA: E. Diskette Format: Only the following industry standard 3-1/2" diskettes, formatted using the MS-DOS operating system, are acceptable; in order of preference: Double sided, high density, 1.44 megabytes Double sided, double density, 720K bytes.

3. Use the MS-DOS BACKUP command to create the file. This command allows a large file to span multiple diskettes.]

### ***Disk Label***

[COE: The Contractor shall affix a permanent exterior label to each disk submitted. The label shall indicate the type of schedule (Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the [ MS-DOS or XX ] version used to format the disk.]

[VA: G. Exterior Label Information: Provide the following information on an external label attached to the diskette(s):

1. VA project number and project location.
2. Name and telephone number of a point of contact, preferably the person who created the diskette(s).
3. Version number of the MS-DOS operating system used to create the diskette(s).
4. The diskette number and total number of diskettes in the set (e.g., 1 of 5).

H. Data Record Specifications: Enter each activity as either a Work Activity or a Dummy Activity, but not both (see Record Type " 1 " specifications). If the Work Activity has any Manpower greater than zero, generate a Record Type " 4 " record. If the Work Activity has Cost greater than zero, generate a Record Type " 5 " record. The

total number of Work and Dummy activities (Record Type "1") will not exceed the maximum number of activities required by 1.6.D above.]

### ***File Name***

**[COE:** The Contractor shall insure that each file submitted has a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will insure that the names of all the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for Approval.]

### **[VA:**

1. All data must be provided in a single file. The file name must be "VACPM.DAT."]

## **Narrative Report**

**[COE:** [ Three (3) or XX ] copies of the Narrative Report shall be provided with each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the [ four (4) or XX ] most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken.]

**[GSA:** Submit a narrative report once each month with the updated schedule in a form agreed upon by the Contractor and the Contracting Officer. Include a description of the progress during the last month in terms of activities completed or in progress, a description of problem areas, current and anticipated delaying factors and their estimated impact on the cost of performance of other activities and completion dates, and an explanation of corrective action taken or proposed.]

**[HHS:** A. The monthly submittal to the Contracting Officer shall be accompanied by a written Schedule Narrative and Progress Report. The report shall describe the physical progress during the report period, plans for continuing the work during the forthcoming report period, actions planned to correct any negative float paths, and an explanation of potential delays and/or problems and their estimated impact on performance and the overall project completion date. In addition, alternatives for possible schedule recovery to mitigate any potential delay and/or cost increases should be included for consideration by the Government.

B. The Schedule Narrative and Progress Report shall follow the outline set forth below:

1. Contractor's transmittal letter;
2. Description of the progress made by the Contractor and subcontractors in each area of the project;
3. Changes in activities, original activity durations, logic, interdependencies, milestones, planned sequence of operations, and resource and cost loading of the Project Schedule;
4. Pending items and status thereof, including permits, change orders, time extensions, and non-compliance notices;
5. Status of Contract completion date and milestones (i.e., describe the variance in total float for Contract completion date and milestones from the previous update and the reasons therefore);
6. Current and anticipated delays (describe the cause of the delay and corrective actions to be taken to maintain the Contract completion date and milestones);
7. Description of current and future schedule problem areas;
8. Other project or scheduling concerns including any proposed plant or utility shutdowns and coordination of the work with other contractors on-site;
9. Include as tabbed appendices Contractor's reviewed and updated network diagrams and schedule reports, in paper copy and on computer diskettes;
10. Include as tabbed appendices Contractor's reviewed and updated Earned Value Report, Net and Cumulative Cash Flow Earnings and Projection, Net and Cumulative Trade Manpower Requirements Forecast, and Construction Equipment Report.

C. The Contractor shall submit six (6) complete copies of the Schedule Narrative and Project Report (8-1/2" x 11" format) to the Contracting Officer each month.]

**[NAVY:** Submit a narrative report describing current and anticipated problem areas and/or delaying factors with their impact together with an explanation of corrective actions taken or proposed. Produce, from the marked-up Look-Ahead Report, updated required sorts for the project and use the accumulated cost for completed and partially completed activities as the basis for requesting progress payments, pursuant to, "FAR 52.232-5, Payments Under Fixed-Price Construction Contracts" and "FAR 52.236-5, Schedules for Construction Contracts." Contract status shall be evaluated on the basis of relative float on the critical path at the time of updating with negative relative float indicating the contract is behind schedule and positive relative float indicating status ahead of schedule. (Relative float is the current status of an activity in relation to the approved schedule completion date.) Submit three copies of the required sorts listed in paragraph entitled, "Required Sorts" and the Look-Ahead Report with each payment request.]

[STATE: f. Narrative report, required to accompany each monthly arrow diagram, is to describe in detail how and why the past month of performance exceeded or fell below the previously reported projections for the month. Also, describe how and why significant changes in network logic have been made since last report, including those related to Contract Modifications, which have been implemented through past month. Highlight significant schedule revisions resulting from changing conditions at Project Site, or locations where materials are being produced and fabricated, and similar problem areas or beneficial turn-of-events which can be predicted to affect job progress. Outline corrective actions implemented to either overcome problems or take advantage of beneficial situations.]

[VA: The Contractor shall provide this information to the Contracting Officer or the VA representative in completed form three work days in advance of the progress meeting. Job progress will be reviewed to verify:

1. Actual finish dates for completed activities.
2. Remaining duration, required to complete each activity started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the arrow diagram and computer-produced schedules. Changes in activity sequence and durations which have been made pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
4. Percentage for completed and partially completed activities.
5. Logic and duration revisions required by this section of the specifications.

B. The Contractor shall submit a narrative report as a part of his monthly review and update, in a form agreed upon by the Contractor and the Contracting Officer. The narrative report shall include a description of problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates; and an explanation of corrective action taken or proposed. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.

C. After completion of the joint review and the Contracting Officer's approval of all entries, the VA will generate an updated computer-produced calendar-dated

schedule and supply the Contractor with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.

D. After each monthly update, the Contractor shall submit to the Contracting Officer three blue line copies of a revised complete arrow diagram showing all completed and partially completed activities, contract changes and logic changes made on the subject update. Monthly updates using the interim arrow diagram are exempted from this requirement.]

**[VOA:** The Contractor shall provide the Contracting Officer and/or ARCO a Progress Report by the 10th of the month including, but not limited to, the following:

1) Working Schedule -The Working Schedule shall indicate the current status of all activities and milestones, as updated, in the approved Target Schedule.

2) Update Report - The Update Report shall indicate the status of all activities and milestones that were completed, in progress, or initiated during the current update period or which are scheduled to start or occur during the next 60 calendar days.

Approximately two days prior to the last working day of each month, the Contractor shall meet with representatives of the Government to review the status of its progress during that month. This becomes the current update period. The Update Report submitted with the Contractor's previous Monthly Progress Report shall be jointly annotated by the Contractor and a Government representative to indicate the following:

Actual start dates of the activities initiated during that month;

Actual finish dates of activities completed during that month;

Estimated time required, i.e., remaining duration, in working days, to complete each activity already in progress or started during the month, but not completed; and

Estimated percent complete of each activity in progress or started, but not completed, during the month. (These estimates shall be based on physical quantity of work in place or the remaining duration versus target duration or other basis approved by the ARCO. They will also be the basis for all subsequent billings.)

Prior to the implementation of field activities, the Update Report shall be reviewed by the ARCO in a meeting with a representative of the Contractor in the ARCO's

Washington, D.C. office. Once field activities have begun, the status of the field work shall be reviewed by the Contractor's senior field representative and the VOA's Construction Manager. The status of manufacturing activities shall continue to be reviewed by the Contractor and the VOA ARCO in Washington, D.C. The annotated Update Report shall be submitted to the ARCO by the first day of the following month, i.e., the month immediately following the update period. The annotated report shall be used by the Contractor to prepare the Working Schedule, Milestone Report, and Update Report for the next update period. Progress reported shall be used as the basis for all billings.

The Contractor shall prepare and submit the Monthly Status Reports as specified herein and in Section F. Each report shall provide a detailed summary of the progress of the work. Reports shall be submitted within 10 calendar days after the first day of each working month and reflect the activities of the previous month.

H.1.3.1.1 Format: The Contractor shall adhere to the following format in preparation and submittal of the Monthly Status Report.

H.1.3.1.2 Introduction: This section shall include a brief description of appropriate project background information and objectives and a brief narrative summary of the major accomplishments during the reporting period.

H.1.3.1.3 Project Activities: This section shall include a narrative discussion of the work performed during the update period including the overall status of major or critical activities and/or milestones as of the end of the update period.

H.1.3.1.4 Government Contacts: The following listings shall be provided (these can be attachments to the report).

H.1.3.1.4.1 Correspondence to USIA: Listing of all documents, letters, telexes, facsimiles, etc., pertinent to this contract, forwarded to USIA and other contractors to include the reference numbers, dates, and subjects.

H.1.3.1.4.2 Correspondence from USIA: Listing of all documents, letters, telexes, facsimiles, etc., pertinent to this contract, received from USIA and other contractors to include the reference numbers, dates, and subjects.

H.1.3.1.4.3 Conferences/Meetings: Listing of all conferences and meetings, pertinent to this contract, with USIA personnel and/or personnel from other contractors to include the personnel attending, dates, and subjects.

H.1.3.1.4.4 Telephone Conversations: Listing of all telephone conversations, pertinent to this contract, with USIA personnel and personnel from other contractors to include the personnel, date, and subject.

H.1.3.1.5 Monthly Working Schedule: This section shall include the Working Schedule, Milestone Report and Update Report as described in the "Contractor Reporting" Section above. These reports shall be included as attachments to the Monthly Status Report.

H.1.3.1.6 Problem Areas and Solutions: This section shall address all problem areas identified in the Monthly Status Reports regarding any aspect of the project. Problems related to the goals of the project, schedule slippages, cost overruns, and/or any other actual or potentially adverse situations shall be fully explained and clearly identified. Specifically, the Contractor shall address in detail:

(a) Activities, or sets of activities, that are behind schedule, their effect on completion of the project, and steps being taken to remedy the situation.

(b) Other information which defines cause and effect of significant changes in the contract schedule.

(c) Recommended solutions to overcome the problems identified.

H.1.3.1.7 Planned Activities: All of the major activities planned for the upcoming month shall be fully described in this section.

H.1.3.1.8 Financial Status: This section of the report shall summarize the financial status of the project. It shall indicate the original contract amount, the cost of any approved modifications, the estimated cost of any anticipated modifications and/or outstanding and anticipated claims, and the amount of all billings presented and payments made to date. Anticipated modifications and claims shall be described and their estimated costs stated.

H.1.3.1.9 Miscellaneous: The Contractor shall address in this section all other information of importance to the project.



#### H.1.3.1.4.10 Report Preparation

The report shall be prepared as follows:

It shall be typewritten or clearly lettered and copies shall be reproduced with non-fading ink on 8 1/2" x 11" paper (or approximate).

The data indicated below shall be contained on the title page in a 3 1/2" x 1 1/2" rectangle located three inches from the top of the page and two and one-half inches from its unfastened edge:

- a. Report Title, e.g., Monthly Status Report;
- b. Project title;
- c. Contract number;
- d. Dates of the reporting period;

Other necessary information may be included elsewhere on the title page.

Attachments are to be prepared on standard letter size paper or standard D size engineering drawing paper. Each attachment shall be fully identified and shall be referenced in the text of the report.

#### H.1.3.2 WEEKLY INSTALLATION REPORT - SITE INSTALLATION EFFORTS

The Contractor's senior field representative at each site shall prepare and submit 2 copies of the Weekly Installation Report. One copy shall be to VOA's On-Site Construction Manager and one copy shall be submitted to the ARCO. Each report shall provide a comprehensive summary of the equipment installation and associated activities for one workweek and shall be submitted on the first workday of the following week.

H.1.3.2.1 Format: The Weekly Installation Report shall follow the Contractor's standard reporting format, provided all reporting requirements are met.

#### H.1.3.3 MEETING CONFERENCE REPORTS

The Contractor shall submit a meeting conference report after each meeting or formal conference between contractor personnel, USIA personnel, or personnel from other contractors. This report shall be submitted within 5 calendar days after completion

of the meeting or conference. Each report shall include but not be limited to the following:

Date and place of conference;

Names and affiliations of all participants;

Subjects discussed; and

The Contractor's understanding of all decisions, conclusions, and directions which were arrived at during the meeting.

**H.1.3.4 QUARTERLY STATUS REVIEW:** The Contractor shall make a detailed quarterly presentation to the ARCO on the status of the work. The presentation shall be made in the VOA offices in Washington, D.C. The agenda for each Quarterly Status Review shall be submitted in advance by the Contractor and approved by the ARCO.]

### **Approved Changes Verification**

**[COE:** Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The [ three (3) or XX ] copies of the Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes. ]

**[HHS: B.** The Project Schedule and associated reports shall be reviewed for the purpose of verifying:

1. Actual start dates;
2. Actual finish dates;
3. Cost value of work reported in place;
4. Activity percent complete for activities in progress as of the start date;
5. Revised logic and changes in activity duration, cost, and manpower assigned;
6. Influence of change orders;
7. Revisions due to unauthorized modifications;
8. Incorporation of approved time extensions.

4.01 The Contractor shall prosecute the work in accordance with the approved Project Schedule. Out of sequence construction, defined as a change from the Project

Schedule in the Contractor's actual operations, requires prior approval from the Contracting Officer.

4.02 Upon the approval of a change order or the issuance of a unilateral change order by the Contracting Officer, the agreed upon change order activities, activity duration, logic, and impacts shall be reflected in the next schedule submittal by the Contractor.

4.03 No change to the approved activities, original activity duration, logic, interdependencies, milestones, planned sequence of operations, or resource and cost loading of the baseline Project Schedule shall be made without prior written approval from the Contracting Officer. If the Contractor desires to make a change to the approved baseline Project Schedule, the Contractor shall request permission from the Contracting officer in writing, stating the reasons for the change as well as the specifics, such as the proposed changes in activities, original activity duration, logic, interdependencies, milestones, planned sequence of operations, or resource and cost loading of the baseline Project Schedule. The Contracting Officer shall respond within fourteen (14) calendar days after the receipt of the Contractor's request.

4.04 If the Contracting Officer considers the Project Schedule change requested by the Contractor to be of a major nature, the Contracting Officer may require the Contractor to revise and submit for approval, without additional cost to the Government, all of the affected portions of the network diagrams, and any schedule reports, cost and cash flow projections, manpower forecasts, or construction equipment reports deemed necessary to show the probable effect on the entire project. The proposed network revision and required reports shall be submitted to the Contracting Officer within seven (7) calendar days after the Contracting Officer notifies the Contractor that the requested revision is of a major nature. Only upon the approval of the requested change by Contracting Officer shall it be reflected in the next Project Schedule update submitted by the Contractor.

4.05 A change will be considered of a major nature if the time estimated for an activity or sequence of activities is varied from the original plant to the degree that there is reasonable doubt that the Contract completion date or milestones will be met, or if the change impacts the work of other Contractors at the job site. Changes to activities having adequate float shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when such changes affect the Contract completion date or milestones.]

[NAVY: Conformed modifications and pending proposed changes shall be shown on the update report. *[To be included in monthly schedule updates]* ]

[STATE: A. General: Except as agreed upon or directed by Project Director at monthly coordination meeting, mark up minor corrections on each issue of progress report (arrow diagram and computer-produced schedules/reports). Where major corrections or changes of real substance, as determined by Project Director, are discovered in monthly coordination meeting or by subsequent analysis of the circumstances, promptly revise input, rerun on computer, reprint, and reissue monthly progress report. Failure by Government (or anyone else) to detect errors or omissions in monthly CPM scheduling of progress, will not be allowed as justification for Contract Modifications. Except as otherwise indicated by Project Director, data accepted in monthly CPM scheduling of progress will be allowed in support of Contractor's monthly payment request, which will not be processed for payment without such supporting data.]

[VOA: If the Contractor desires to make a change to the approved Target Schedule, he shall notify the ARCO in writing stating the reason for the change, listing the revised features of the work, and displaying how the change affects the remaining work. Any desired change which involves the assigned cost or duration of an activity, an activity's start or finish constraints, the addition or deletion of activities, or changes in activity relationships, requires the prior written notification and subsequent approval of the ARCO. If the ARCO considers a change to be of a major nature, the Contractor shall revise and submit for approval all or just the affected portion of the approved Target schedule to show the effect on the entire project and how the Contractor intends to accomplish the remaining work on or before the specified contract milestone and activity completion dates. A clear, detailed listing of all changes shall be provided. The Contractor shall neither modify the approved Target Schedule and any associated reports to reflect a requested change nor implement the change until approval of the ARCO has been obtained. If unapproved changes to the Target Schedule are encountered, the government may direct the contractor to remove them and resubmit the Target Schedule for approval at no expense to the government. Progress payments may also be suspended until such a time as the Target Schedule is again approved by the ARCO.]

## Schedule Reports

[COE: The format for each activity for the schedule reports listed below shall contain: Activity Number(s), Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float.

Actual Start and Actual Finish Dates shall be printed for those activities in-progress or completed. [ Three (3) or XX ] copies of the reports listed below are required:

a. Activity Report: A list of all activities sorted according to [ activity number or "I-node" and "j-node" ] and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

b. Logic Report: A list of Preceding and Succeeding activities for every activity in ascending order by activity number and then sorted according to Early Start Date. For completed activities the Actual Start Date shall be used as the secondary sort.

c. Total Float Report: A list of all activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates.

d. Earnings Report: A compilation of the Contractor's total Earnings on the project from the Notice To Proceed until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and then Sorted by activity number(s). This report shall: sum all activities in a bid item and provide a bid item percent complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: [ Activity Number or "I-node" and "j-node" ], Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), Earnings to Date. ]

[GSA: A. Furnish with the arrow diagram, and each revision thereof, a computer-produced schedule showing the following minimum data for each activity:

1. Activity beginning event number.
2. Activity ending event number (mandatory only when format is used).
3. Activity description.
4. Activity duration estimate.
5. Activity cost estimate.
6. Trade code (responsibility code including Contractor, subcontractors, supplier and Government).
7. Early start date -by calendar date.
8. Early finish date -by calendar date.
9. Late start date -by calendar date.

10. Late finish date -by calendar date.
11. Actual start date -by calendar date.
12. Actual finish date -by calendar date.
13. Total float.
14. Percent completed.

B. As a minimum, the following computer-produced report sorts of the basic activity data shall be supplied with clear identification on the first page of each report:

1. Activity listing by number sequence.
2. Activity sort by total float -early start date -early finish date.
3. Activity sort by trade -early start date -total float.
4. Contractor's monthly payment request sorted by responsibility.]

**[HHS:** A. The Project schedule shall include time scaled network diagrams, computer generated mathematical analysis reports, and associated reports as required by this Specification section. The mathematical analysis reports shall include, at a minimum, the following information:

1. Activity number(s) and descriptions;
2. All WBS codes
3. Original and remaining durations for each activity;
4. Early start by calendar date;
5. Early finish by calendar date;
6. Late start by calendar date;
7. Late finish by calendar date;
8. Actual start by calendar date;
9. Actual finish by calendar date;
10. Total float in work days;
11. Monetary value of each activity;
12. Percentage of activity complete linked to remaining duration;
13. Contractor's earning, based on the Contractor's reported portion of activities completed and accepted;
14. Imposed constraints

B. The following computer generated reports in hard copy (8-1/2" x 11" format) and on computer diskettes (two (2) copies of all P3 data) shall be required as part of

the baseline Project Schedule submittal and each revision or monthly update thereof as a condition precedent to the receipt of progress payments under the Contract:

1. Schedule report by activity number from lowest to highest, including restraints;
2. Schedule report by total float from lowest to highest, then by activity number, for all activities including restraints;
3. Schedule report by early start date for the next fifty (50) work days, then by activity number;
4. Schedule report by late finish date for the next fifty (50) work days, then by activity number;
5. Schedule report by organizational responsibility (contractor, subcontractors, suppliers, Government), then by activity number.]

**[NAVY:** Show the order and interdependence of activities and the sequence in which the work is to be accomplished as planned. The basic concept of a network analysis diagram will be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion restricts or restrains the start of following activities. In addition to construction activities, detailed network activities shall include the submittal and approval of materials, samples, and shop drawings, the procurement of critical materials and equipment, receipt of materials with estimated procurement costs of major items for which payment of materials will be requested in advance of installation, fabrication of special material and equipment, and their installation and testing. Show activities of the Government that affect progress and contract-required dates for completion of all or parts of the work. Show activities indicating Government furnished materials and equipment utilizing delivery dates indicated in "FAR 52.245-2, Government Furnished Property (Fixed-Price Contract)." Show the following information on the diagrams for each activity:

- a. Preceding and following event numbers,
- b. Description of the activity,
- c. Cost where applicable for the activity,
- d. Duration in work days.

List the activities in sorts or groups as follows:

- a. By the preceding event number from lowest to highest and then in the order of the following event number (I-J Look-Ahead Report) showing the current status of all activities
- b. By the amount of total float, from lowest to highest and then in order of preceding event number (Total Float or Slack Report) showing all incomplete activities

- c. By latest allowable start dates, then in order of preceding event numbers, and then in order of succeeding event numbers (Late Start Report) showing all incomplete activities
- d. Contractor's monthly payment request sorted by responsibility code with summary (cost earned by Responsibility Code Report)
- e. Early Start Report
- f. Listing of input data which generates the Input Data Report.]

[STATE: d. Computer-produced schedule, required to accompany each monthly arrow diagram, include the following data as projected or recorded for each activity, as applicable:

- 1) Description, including trade or responsibility code (Contractor, subcontractor, supplier, Government).
- 2) Beginning event number and, where applicable to format used, ending event number.
- 3) Estimated activity duration (working days).
- 4) Estimated activity cost.
- 5) Early start and early finish dates.
- 6) Late start and late finish dates.
- 7) Actual start and actual finish dates.
- 8) Total float, in working days.
- 9) Percent complete as of report date.
- 10) Review substantive changes in input data for any of foregoing, with Project Director, prior to production of each monthly report.

e. Computer-produced sorts, re-colored to accompany each monthly arrow diagram, include the following properly identified reports:

- 1) Activity listing, by number sequence.
- 2) Activity sort by total float, early start date, early finish date.
- 3) Activity sort by trade, early start date, total float.
- 4) Contractor's monthly payment request, sorted by responsibility.

b. Supporting and coordinating data submittals include the schedule of submittals, schedule of values, schedule of GFE, occupancy schedule, listing of entities performing work, listing of products, certain close-out submittals, and similar submittals as specified in these Contract Documents. Prepare and include updated submittal, with listing of costs (recorded and estimated) for units of work of the Contract, totaling the Contract Amount.



c. Produce work-flow estimates as supporting schedules or listings for the entire Contract Time; and update/distribute each month with CPM schedule. Include recorded amounts for periods prior to date of report, and estimated amounts for subsequent periods. Provide the following data:

1) Weekly cash flow, or value of work installed/to-be-installed; with projected values indicated on summations of both early and late finish dates, for activities not on the critical path.

2) Weekly average number of work persons at Project Site; based on regular work hours, except as noted to include extended hours or extra shifts.]

**[VOA:** In order to provide effective schedule performance and cost monitoring, the Contractor shall provide the following information/reports in its Monthly Status Report:

**Working Schedule Report:** The Working Schedule Report shall indicate the status of all activities and milestones contained in the entire approved Target schedule.

**Milestone Report:** The Milestone Report shall indicate the actual or anticipated dates of all contract milestones.

**Update Report:** The Update Report shall indicate the status of all activities and milestones that were completed, in progress, or initiated during the current update period or which are scheduled to start or occur during the next eight weeks. It will be formatted to allow its annotation to reflect status at the conclusion of the next update period. The annotated Update Report shall be used by the Contractor to generate the schedule reports submitted with the next Monthly Status Report.

The Working Schedule and Milestone Reports shall be provided sorted by the activity/milestone identifier. The Update Report shall be provided in duplicate with one set sorted chronologically by early start and the other set sorted by the activity/milestone identifier. Each report shall be in tabular format indicating description, remaining duration, performance responsibility, actual or planned early and late start and finish dates, and associated float for each activity and milestone.]

## Network Diagram

[COE: The network diagram shall be required on the initial schedule submission [ and on monthly or quarterly schedule update submissions ]. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer shall use, but is not limited to, the following conditions to review compliance with this paragraph:

a. Continuous Flow: Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity or event number, description, duration, and estimated earned value shall be shown on the diagram.

b. Project Milestone Dates: Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

c. Critical Path(s): The critical path(s) shall be clearly shown.

d. Banding: Activities shall be grouped to assist in the clear understanding of the activity sequence.

Typically, this flow will group activities by category of work, work area and/or responsibility.

e. S-Curves: Earnings curves showing projected early and late earnings and earnings to date.]

[GSA: The detailed arrow diagram shall show the sequence and interdependence of activities required for complete performance. In preparing the arrow diagram, break up the work into activities of a duration of no longer than fifteen working days each, except for non-construction activities (such as procurement of materials, delivery of equipment and concrete curing) and any other activities for which the Contracting Officer may approve the showing of longer duration. The selection and number of activities will be subject to the approval of the Contracting Officer. The diagram shall show not only the activities for actual construction work for each trade category of the project, but also all other activities that affect progress, such as including submittal of shop drawings, equipment schedules, samples, coordination drawings, templates, fabrication, delivery and the like, the Government's review and approval of shop drawings, equipment schedules, samples and templates, and the delivery of Government-furnished equipment or partition drawings, or both. Show activity duration (i.e., the single best estimate, considering the scope of the activity and the resources planned for the activity) for each activity on the diagram. Failure to include any

element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the Contracting Officer's approval of arrow

A. Furnish the following supporting data with the arrow diagram:

1. Cost estimate for each activity. The total of all activity costs shall equal the contract price.
2. Other data such as the proposed number of working days per week, manpower allocation by crew size and type, the planned number of shifts per day and the number of hours per shift.

B. Furnish with the arrow diagram, and each revision thereto which affects the contract time, cash flow in a suitable scale indicating graphically the total percentage of activity dollar value, scheduled to be in place based on both early and late finish dates. ]

**[HHS:** The detailed CPM network diagrams shall show the sequence and interdependence of activities required for complete performance. It shall be organized to show the order in which the Contractor proposes to carry out the work, to indicate restrictions of access and to show availability of work areas, and availability and use of manpower, materials, and equipment. The Contractor shall utilize the network diagrams in planning, scheduling, coordinating and performing the work under the Contract, including all activities of subcontractors, equipment vendors, and suppliers.

E. The network diagrams shall be prepared on "E" size sheets (28 inches by 40 inches), and they shall have a title block and a calendar day time line on each page. All networks shall be time scaled to show a continuous flow of information from left to right. The critical path shall be clearly and graphically identified on the network diagrams. Near critical paths shall also be shown graphically, using a style that is distinct from the critical path.]

**[NAVY:** The network diagram mathematical analysis shall include a tabulation of each activity shown on the detailed network diagrams. Provide the following information as a minimum for each activity:

- a. Preceding and following event numbers
- b. Activity description
- c. Estimated duration of activities (by work days)
- d. Earliest start date (by calendar date)
- e. Earliest finish date (by calendar date)

- f. Actual start date (by calendar date)
- g. Actual finish date (by calendar date)
- h. Latest start date (by calendar date)
- I. Latest finish date (by calendar date)
- j. Total float or slack
- k. Monetary value of activity
- l. Responsibility code (including prime contractor, subcontractors, suppliers, Government, or other party responsible for accomplishment of an activity)
- m. Manpower required (by area of the project in which the work will be performed)
- n. Percentage of activity completed
- o. Contractor's earnings based on portion of activity completed

The program or means used in making the mathematical computation shall be capable of compiling the total value of completed and partially completed activities. The program shall also be capable of accepting revised completion dates as modified by approved time extensions and computation of tabulation dates/costs and float accordingly.

#### 1.6.8 Submission Requirements

Provide network diagrams on size A0-1189 by 841 mm (30 by 42 inch) sheets. Updated diagrams shall show the date of the latest revision.

#### 1.6.9 Summary Network

A summary network shall generally have the same network form as the final submitted NAS Schedule. The summary network will contain a minimal number of activities that represent the general approach of work sequence. It will be a time-scaled logical sequence of work phases, classifications and areas. It will not be necessary to cost load the summary network or show responsibility codes. The Contractor shall submit a summary network diagram immediately after approval of the complete network. A complete update shall be submitted every [6] [ ] months during the contract duration and immediately following approval of each major schedule change. Submit the following:

- a. One mylar or equivalent of the summary network diagram
- b. Three copies of the summary network diagram
- c. Three copies of the summary I-J report
- d. Three copies of the summary Total Float Report

- e. Three copies of the Cash Flow Report indicating the cash flow for the current complete (not summary) network based upon both the early and late start schedules.]

**[NASA:** The graphic display shall be a standard network or arrow diagram capable of illustrating the required data. Drafting shall be computer generated on standard 24 by 36 inch (nominal size) drafting sheets or on small (11 by 17 inch minimums sheets with separate overview and detail breakouts. Any graphic display siesta used shall be readily legible with a clear, consistent method for continuations and detail referencing. The critical path shall be clearly delineated on the display. When milestone dates are included in the Contract they shall be clearly indicated on the display.

The schedule shall be drawn or plotted, showing activity numbers and descriptions, start and finish dates, and total float; as well as the subcontractor responsible, dollar amounts associated with each of material, labor, and equipment, and crew size.]

**[STATE: C. Detailed Construction Progress Schedule:** In compliance with CC&C; prepare and submit fully-detailed entire construction period, bar-chart type, progress schedule; within 45 days of Government's "Notice to Proceed"; and submit to Project Director. Show time period scheduled for each significant unit of work; with sufficient space along each bar to mark-up record of actual performance or progress of work. List units in vertical order for general sequencing of activities, with uniform weekly vertical lines to show elapsed time horizontally; including work by separate contractors and Government, which is within or overlaps Contract Time for this Construction Contract.

1. Show actual progress time bars, as recorded during first 30-to-45 days by Initial Progress Schedule; and proposed time bar, for each entity's unit of work, as agreed upon by related entity in each case. Mark each time bar, which exceeds 8 weeks in length, into incremental work segments, each representing 10 percent completion.

2. Prepare on a series of reproducible sheets, each not exceeding 33 x 25.5 inch (838 x 648 mm) overall size, and sufficient in number to contain: 1) Vertically, the complete listing of units of work to be scheduled; and 2) Horizontally, the complete Construction Time, plus 10 percent extra space for possible extension of time.

3. Provide each sheet of composite schedule with sufficient space to record applicable heading data, including month/year and first working date of each week; along with project name/number/location/date and similar identification. Provide extra space under heading of each top sheet of composite schedule, for the purpose of

recording not less than 10 special time lines, each with adjacent mark-up space; to be used for summarized information such as value of work-in-place, total personnel count at Project Site, and similar requirements as may be specified or requested by Project Director.

4. Provide each left-hand margin of each left-hand sheet with column spaces for indicating: 1) Line number for quick reference, 2) Unit of work name/designation, 3) (Unrelated) percent complete column for purposes of imposing "S" curves of scheduled and actual job progress, and 4) Extra width of not less than 4 inches (102 mm) for the subsequent insertion of other line designations and indicators, as may be requested by Project Director.

5. After receiving and sequencing analysis of appropriate information concerning performance of each unit of work, including work by separate contractors and by Government; and including time frames for preparation and processing of submittals, manufacturing, fabrication, delivery, installation, and other time requirements; plot time bars in a logical sequence for related units of work, and determine which units of work constitute the initial critical path of the construction progression. Position those units-of-work installation time bars horizontally, with 50 percent of initial total float time (if any) distributed uniformly between unit bars, and with the remaining 50 percent located at the right margin, forming cushion ahead of "date of substantial completion." Provide distinctive graphic treatment for recognition of initial units of work on the critical path. In general, position those unit-of-work installation time bars, which are not on the critical path, with 25 percent of each individual float time to the left, and with 75 percent to the right.

6. Where phase installation for multiple units of work is required, treat each phase of each unit as a separate unit of work, in the assembly and sequencing of related time bars shown on the schedule. Treat other segments of work requiring individual progress scheduling in the same manner; e.g., separate stories of construction; as requested by Project Director.

7. On each unit-of-work time line, to the left of the installation time bar, show by separate graphic symbol the dates, where applicable, for initial submission of product data, shop drawings, and samples, including mock-ups and samples for testing. Indicate major milestone dates in progress of work on separate time lines of schedule.

a. Produce each (monthly) arrow diagram as a single sheet; either as direct output (by machine) of the CPM program, or manually drawn from data output of processing data on the CPM program. Total diagram, including reproduced copies of total diagram,

may (at Contractor's option) be composed of segments of the diagram, "glued" together to form a single-sheet arrow diagram; which must not exceed 66 inches x 46 inches high (1676 x 1168 mm), in any case. Arrow diagram of initially updated report must have time expenditures accurately scaled; subsequent reports may be to only approximate scale, at Contractor's option.]

**[VA:** Within 90 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review five blue line copies of the complete arrow diagram on sheets of paper 30 inches by 42 inches and 3-1/2" diskette(s) as specified. The submittal shall also include five copies of a computer-produced I-J schedule showing project duration; phase completion dates; all dummies; and other data, including activity cost. Each activity on the computer-produced schedule shall contain as a minimum, but not limited to, I-J nodes, duration, trade code, area code, description, budget amount, early start date, early finish date, late start date, late finish date and total float. The complete working arrow diagram shall reflect the Contractor's approach to scheduling the complete project, taking into account the accuracy of the logic and the experience gained from the interim diagram. The final diagram in its original form shall contain no contract changes or delays which may have been incurred during the interim diagram period. These changes/delays shall be entered at the first update after the final diagram has been approved. The Contractor should provide their request/time extension analysis for contract time as a result of these contract changes/delays after this update and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

B. Within 30 calendar days after receipt of the complete project arrow diagram, the Contracting Officer or his representative, will do one or both of the following:

1. Notify the Contractor concerning his actions, opinions, and objections.
2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit five blue line copies of the revised arrow diagram, five copies of the revised computer-produced (I-J) schedule and a revised 3-1/2' diskette(s) to the Contracting Officer. The resubmission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

C. The VA will process and return approved arrow diagram and computer reports as specified to the Contractor. The approved arrow diagram and the computer-produced schedule(s) generated therefrom shall constitute the project work schedule until subsequently revised in accordance with requirements of this section.

## 1.8 ARROW DIAGRAM REQUIREMENTS

A. Show on the arrow diagram the sequence and interdependence of activities required for complete performance of all items of work. In preparing the arrow diagram, the Contractor shall:

1. Exercise sufficient care to produce a clear, legible and accurate diagram, refer to the drawing, CPM-1 (Sample CPM Network). Computer plotted arrow diagrams shall legibly display and plot all information required by the VA CPM activity legend or the computer plotted diagram will not be acceptable. Group activities related to specific physical areas of the project, on the diagram, for ease of understanding and simplification. Provide a key plan on each diagram sheet showing the project area associated with the activities shown on that sheet.

C. To the extent that the arrow diagram or any revised arrow diagram shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Contracting Officer. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the Contracting Officer's approval of the arrow diagram.]

### Periodic Progress Meetings

[COE: Progress meetings to discuss payment, shall include a monthly on-site meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor will describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer or approved representative shall approve activity progress, proposed revisions, and adjustments as appropriate.

- a. Meeting Attendance: At a minimum, the Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

- b. Update Submission Following Progress Meeting: A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than four (4) working days after the monthly progress meeting.]

[HHS: A. The initial Project Schedule update shall take place during the first week after approval of the Contractor's baseline Project Schedule and associated reports.



Subsequent updates shall be submitted to the Contracting Officer each month thereafter, on a date assigned by the Contracting Officer, for the duration of the Contract. The Project Schedule update and associated reports shall be reviewed by the Contractor's Construction Scheduler and the Contracting Officer at a joint meeting to be held within seven (7) calendar days after the Contracting Officer's receipt of the Contractor's monthly update.]

**[NASA:** The Contractor shall attend a weekly progress/status meeting to be scheduled by the Contracting Officer for the purpose of determining progress status, delaying factors, material delivery schedules and status of shop drawing submittals. In addition, a representative of each first tier subcontractor shall be present for the conference.]

**[STATE:** 8. Date and update the progressive mark-up of the reproducible progress schedule sheets within 7 days prior to each Progress Meeting, and post a print of marked-up schedule for meeting. Monitor progress daily, in an effort to meet and improve upon commitment dates for every unit of work currently in progress; including submission, procurement, fabrication, delivery, and installation. Prior to monthly progress meeting, inspect progress of work at Project Site, jointly with Project Director, recording work in progress, percentages of completion, and projected completion dates. Attach record of joint inspection to written monthly progress report, which records significant job conditions and circumstances which are affecting or could affect job progress. Incorporate information developed at monthly progress/coordination meeting, and distribute copies of report and updated schedule to primary entities currently involved with performance of the work, including the Project Director. In each monthly report, clearly define status of work completion in relation with initial progress schedule, with special notations of actions, or lack thereof, which could threaten sustained progress as scheduled to have begun, but are actually yet to begin; with specific notation of such actions which are on the critical path or, by delay, have become or are threatening to become elements of the critical path.]

**[VA:** A. Monthly job site progress meetings shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's representative) and the Contractor. Contractor and the CPM consultant will be required to attend all monthly progress meetings. Presence of Subcontractors during progress meeting is optional unless required by the Contracting Officer (or Contracting Officer's representative). The Contractor shall complete their copy of the "look-ahead report" and all other data required by this section shall be accurately filled in and completed prior to the monthly progress meeting.]

## Progress Meeting Contents

**[COE:** Update information, i.e., Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost to Date shall be subject to the approval of the Contracting Officer or approved representative. The following is a minimum set of items which the Contractor shall address, on an activity by activity basis, during each progress meetings:

a. **Start and Finish Dates:** The Actual Start and Actual Finish dates for each activity currently in-progress or completed activities.

b. **Time Completion:** The estimated Remaining Duration for each activity in-progress. Time-Based progress calculations must be based on Remaining Duration for each activity.

c. **Cost Completion:** The earnings for each activity started. Payment shall be based on earnings for each in-progress or completed activity. Payment for individual activities shall not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

d. **Logic Changes:** All logic changes pertaining to Notice To Proceed on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, [ lag durations ], and any other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

e. **Other Changes:** All other changes required due to delays in completion of any activity or group of activities. Included in these requirements are those delays beyond the Contractors control such as strikes, unusual weather. Also included are delays encountered due to submittals, Government Activities, deliveries or work stoppage which makes replanning the work necessary and when the schedule does not represent the actual prosecution and progress of the work. ]

**[VOA: (100K-1M)** Approximately two days prior to the last working day of each month, the Contractor shall meet with representatives of the Government to review the status of its progress during that month. The Update Report submitted with the Contractor's previous Monthly Progress Report shall be jointly annotated by the Contractor and the Government representative to indicate the following:

- 1) Actual start dates of activities initiated during the month.

- 2) Actual finish dates of activities completed during the month.
- 3) Estimated time required, i.e., remaining duration, in calendar days, to complete each activity already in progress or started during the month.
- 4) Estimated percent complete of each activity in progress or started during the month. These estimated percentages will be the basis for progress payments. (These estimates shall be based on the physical quantity of work completed, not on resources expended).]

### **Justification of Contractor's Request for Time**

**[COE:** In the event the Contractor requests an extension of the contract completion date, he shall furnish such justification, project schedule data and supporting evidence as the Contracting Officer or approved officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.]

**[HHS:** A. When change orders or delays are experienced by the Contractor and the Contractor requests an extension of time under one or more of the Contract clauses, the Contractor shall submit a written Time Impact Analysis (TIA) illustrating the influence of each change or delay on the Contract completion date or milestones, utilizing the current updated Project Schedule. Each TIA shall include a fragnet demonstrating how the Contractor proposes to incorporate the change order or delay into the Project Schedule. A fragnet is defined as a sequence of new activities and/or activity revisions that are proposed to be added to the existing schedule to demonstrate the influence of delay and the method for incorporating delays and impacts into the schedule as they are encountered.

B. Each TIA shall demonstrate the estimated time impact based on the date the change was issued to the Contractor, the events of the delay, the status of construction at that point in time, and the event time computation of all activities affected by the change or delay. The event times used in the TIA shall be those included in the latest update of the Project Schedule in effect at the time the change or delay was encountered.

C. Each TIA shall be submitted in six (6) copies (8-1/2" x 11" format) for the approval of the Contracting Officer within seven (7) calendar days after a notice to proceed for change is issued or an actual delay encountered by the contractor.]

**[NAVY:** Extension of time for performance required under the clauses entitled, "Changes," "Differing Site Conditions," "Default (Fixed-Price Construction)" or "Suspension of Work" of the Contract Clauses will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total float or slack along the network paths involved. Submit time extension requests with a narrative report supporting the request and three copies of the Total Float Report and input data if a mathematical analysis is necessary to support the narrative report.]

**[POST:** a. The contractor's written statement of the monetary extent of any claim for equitable adjustment under this contract must be submitted in the form of a lump sum proposal (unless otherwise requested) with an itemized breakdown of all increases or decreases in the cost of the contractor's and all subcontractors' work, in at least the following detail:

- (1) Material quantities and unit cost
- (2) Labor costs (identified with specific item of material to be placed or operation to be performed)
- (3) Construction Equipment
- (4) Workmen's Compensation and Public Liability Insurance
- (5) Overhead
- (6) Profit
- (7) Employment taxes under FICA and FUTA]

**[VA:** A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity logic duration and costs is obligatory to any approvals. The schedule must clearly display that the schedule has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

B. If the time period(s) in question occurred during the interim diagram update(s), such update(s) must be converted to the approved complete project arrow

diagram, which will then be used as the basis for the time extension request(s). Actual delays in activities which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, CHANGES, in the Section, GENERAL CONDITIONS. The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration changes, and cost changes, for work in question and its relationship to other activities on the approved arrow diagram.]

[VOA: If a request for a proposal for a contract change is issued by the Government, the Contractor shall submit a network with its proposal indicating the potential effect, if any, of the proposed change on the approved Target Schedule and contract completion dates. The Contractor shall also submit any related changes in the approved Work Breakdown Structure. If a resulting change order for additional work is issued without a mutual agreement on its effect on the approved Target Schedule and if the Contractor fails or refuses to submit a network showing the revised features of work and how the change affects the remaining work, the ARCO shall furnish logic and duration revisions in the next regular updating of the approved Target Schedule that shall be used until the issue is resolved. The Contractor's failure to submit a counter plan within 10 calendar days shall constitute concurrence in the ARCO's suggested revisions. The schedule into which the logic and duration revisions have been incorporated, either those proposed by the ARCO and unchallenged by the Contractor or those proposed by the Contractor and approved by the ARCO, shall become the revised approved Target Schedule for continued evaluation of progress and shall be used as the basis to determine any future time extensions.]

### **Justification of Delay**

[COE: The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension, shall be based upon the project schedule updates in effect for the time period in question and other factual information. Actual delays that are found to be caused by the contractors own

actions, which result in the extension of the schedule, shall not be a cause for a time extension to the contract completion date.

a. **Submission Requirements:** The Contractor shall submit a justification for each request for a change in the contract completion date of under two weeks based upon the most recent schedule update at the time of the Notice To Proceed or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum: (1) a list of affected activities, with their associated project schedule activity number, (2) a brief explanation of the causes of the change, (3) an analysis of the overall impact of the changes proposed, and (4) a sub-network of the affected area. Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

b. **Additional Submission Requirements:** For any request for time extension for over two (2) weeks, the Contracting Officer or authorized representative may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within four (4) days of the Contracting Officer or authorized representative's request. ]

[NAVY: When a contract modification to the work is required, submit proposed revisions to the network reflecting the impact. Submit the proposed network revisions with the cost proposal for each proposed change. Should it be determined that a mathematical analysis utilizing the computer is necessary to analyze the impact, submit three copies of the Total Float Report and Input Data with the cost proposal. Incorporate contract modifications into the subsequent monthly update. Financial data shall not be incorporated until issuance of a contract modification on Standard Form 30 signed by the Contracting Officer. Those contract modifications determined to have no impact will require only the identification of the affected activities as part of the proposed change proposal.

#### 1.6.5 Changes to the NAS

If changes in the method of operating and scheduling are desired, the Contracting Officer shall be notified in writing stating the reasons for the change. If the Contracting Officer considers these changes to be of a major nature, the Contractor may be required to revise and submit for approval, without additional cost to the Government, network diagrams and required sorts. A change may be considered of a major nature if the estimated time required or actually used for an activity or the network logic is varied from the original plan to a degree that there is a reasonable doubt as to the effect on the contract completion date[s]. Changes which affect activities with

adequate float time shall be considered a major change when their cumulative effect could extend the contract completion date.]

**[VA:** A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity logic duration and costs is obligatory to any approvals. The schedule must clearly display that the schedule has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

B. If the time period(s) in question occurred during the interim diagram updates(s), such update(s) must be converted to the approved complete project arrow diagram, which will then be used as the basis for the time extension request(s). Actual delays in activities which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change in to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified Under Article, CHANGES, in the Section, GENERAL CONDITIONS. The Contractor shall include, as part of each change order proposal, a sketch showing all CPM logic revisions, duration changes, and cost changes, for work in question and its relationship to other activities on the approved arrow diagram.]

**[GSA:** The Contracting Officer may also require the Contractor to submit for approval and at no additional cost to the Government such supplementary progress schedules as may be deemed necessary to demonstrate the manner in which the approved progress schedule will be regained.]

**[HHS:** A. Time extensions of the Contract completion date or milestones will be granted only to the extent that adjustments to the activity or activities affected by a change order or delay affect the critical path of activities leading to the Contract completion date or milestones. This determination shall be made based on the date

that the Contracting Officer issues a notice to proceed with a change or the date an actual delay begins.

B. Approval or rejection of each time extension request shall be made by the Contracting Officer within fourteen (14) calendar days after receipt of each TIA, unless subsequent meetings and negotiations are necessary. Upon approval, a copy of the time extension request, signed by the Contracting Officer, shall be returned to the Contractor for incorporation into the next update of the Project Schedule.

C. In the event the Contractor does not agree with the decision of the Contracting Officer regarding the impact of a change or delay, it shall be resolved in accordance with the disputes clause of the Contract.]

### **Planning for Directed Changes**

[COE: If Notice To Proceed (NTP) is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revision(s) to the Contracting Officer within two (2) weeks of the NTP being issued. The proposed revision(s) to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revision(s), the Contracting Officer may furnish the Contractor suggested revision(s) to the project schedule. The Contractor shall include these revision(s) in the project schedule until the Contractor submits revision(s), and final changes and impacts have been negotiated. If the Contractor has any objections to the revision(s) furnished by the Contracting Officer, then the Contractor shall advise the Contracting Officer within two (2) weeks of receipt of the revision(s). Regardless of the objections, the Contractor will continue to update their schedule with the Contracting Officer's revision(s) until a mutual agreement on the revision(s) may be made. If the Contractor fails to submit alternative revision(s) within two (2) weeks of receipt of the Contracting Officer's proposed revision(s), the contractor will be deemed to have concurred with the Contracting Officer's proposed revision(s). The proposed revision(s) will then be the basis for an equitable adjustment for performance of the work.]

[POST: When notice to proceed with changes in the work must be issued prior to settlement of price and/or time to avoid delay and additional expense, the contractor will revise the network log and/or duration time estimates of all activities affected by the modification on the next succeeding updating report after the date of notice to proceed. These revisions will be submitted for concurrence of the contracting office prior to inclusion in the network.



a. If the contractor fails or refuses to submit or include acceptable revisions within 30 days after the date of notice to proceed, the contracting officer may furnish to the contractor the suggested logic and/or duration time revisions to be entered into the network and used in all subsequent updating reports until such time that the revisions have been settled or until actual dates supersede the portion of the schedule represented by the revisions.

b. In the event the contracting officer has furnished the suggested logic and/or duration time revisions because of the contractor's failure to furnish acceptable revisions on time and the contractor has any objections to the revisions furnished by the contracting officer, the contractor shall notify the contracting officer in writing of such objections, fully supported by its own counter plan. If the contractor fails to submit in writing its objections to the revisions along with supporting data and counter plan within 20 days after the date such suggested revisions have been furnished by the contracting officer, it will be deemed that the contractor has agreed with the contracting officer's suggested logic/duration time revisions, which revisions then will be the basis for equitable adjustment of the time of performance of the work.]

## Ownership of Float

[COE: Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.]

[GSA: Float is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any activity in the project schedule. Total float is defined as the amount of time any given activity or path of activities may be delayed before it will affect the project completion time. Float is not time for the exclusive use or benefit of either the Government or the Contractor, but must be used in the best interest of completing the project on time. Extensions of time for performance required under the General Conditions pertaining to equitable time adjustment will be granted only to the extent that the equitable time adjustment exceeds total float in the activity or path of activities affected at the time notice to proceed was issued for the change. ]

[HHS: A. "Float" or "slack" is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, for all activities in the Project Schedule. Float or slack is not time for the exclusive use or benefit of either the Government or the Contractor.

B. Use of float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity times, or imposed dates, other than as required by the Contract, shall be cause for rejection of the Project Schedule and any revisions or updates.

C. If the Contractor submits a Project Schedule showing a completion of the work more than thirty (30) calendar days in advance of the Contract completion date, the Contractor agrees that the Contracting Officer may, at no cost to the Government, decrease the Contract duration by issuance of a Change Order that will change the Contract completion date and the appropriate milestone dates to the date reflected in the Project Schedule.

D. Any approved schedule, revision, or update having an early completion date shall show the time between the early completion date and the current Contract completion date as "project float."

E. Should the Project Schedule show variances from the requirements of the Contract, the Contractor shall make specific mention of such variances in the letter of transmittal so that, if accepted by the Contracting Officer, proper adjustments to the contract can be made.]

[NAVY: Float or slack is defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date of any of the activities in the NAS Schedule. Float or slack is not time for the exclusive use or benefit of either the Government or the Contractor.]

[VOA: Float or slack is defined as the difference between the early start date and the late start date, or the early finish date and the late finish date of any of the activities in the approved Target Schedule. Extensions in the time for performance shall be granted only to the extent that equitable time adjustments for the activities affected exceed the available total float or slack at the time an extension is granted. Float or slack is not time for the exclusive use or benefit of either the Government or the Contractor.]

## **Prosecution of Work**

[GSA: If in the opinion of the Contracting Officer, the Contractor falls behind the progress schedule, the Contractor shall take any and all steps necessary to improve his progress at no additional cost to the Government, such as the following: 1. Increase construction manpower in such quantities and crafts as will substantially eliminate

the lag in scheduled progress; 2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate lag in scheduled progress; 3. Reschedule sequence activities to achieve maximum practical concurrently accomplishment of work activities.

Failure of the Contractor to comply with the requirements of the Contracting Officer under this paragraph shall be grounds for determination by the Contracting Officer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the applicable provisions of the General conditions.]

**[HHS: A.** Whenever it becomes apparent that any activity completion date may not be met, the Contractor shall take the following actions at no additional cost to the Government: 1. Increase construction manpower to put work back on schedule; 2. Increase the number of work hours per shift, shifts per day, work days per week, amount of construction equipment, or all or any combination of these actions to put work back on schedule; 3. Reschedule activities to achieve maximum practical concurrence to place the work back on schedule.

B. The Contracting Officer may also require the Contractor to submit for approval at no additional cost to the Government such supplementary progress schedules, associated reports, and other supporting data as may be deemed necessary to demonstrate the manner in which the approved Project Schedule will be regained.

Failure of the Contractor to comply with the requirements of the Contracting Officer under this Part 6 shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time or times specified. Upon such determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the applicable provisions of the Conditions of the construction Contract.]

**[NASA:** The schedule shall be an accurate representation of the manner in which the Contractor is performing the work. If circumstances indicate that progress is one week or more behind the contract completion, the Contractor shall revise the schedule and his work plan, to eliminate or minimize delays to contract completion.]

**[POST:** If the contractor fails to make adequate progress and there is no indication of an excusable delay, the CO must consider enforcement action to protect the Postal Service. The action may include an order to increase the work force, use additional equipment, or increase the number of shifts at no additional cost to the Postal Service. The CO may need to issue a notice to either solve the problem or face possible termination for default.

b. If in the opinion of the contracting officer the work actually in place falls behind that scheduled, the contractor must take such action as necessary to improve progress. The contracting officer may require the contractor to submit a revised chart demonstrating its program and proposed plan to make up lag in scheduled progress and to ensure completion of work within the contract time. If the contracting officer finds the proposed plan unacceptable, the contractor may be required to submit a new plan. If a satisfactory plan is not agreed upon, the contracting officer may require the contractor to increase the work force, the construction plan and equipment, or the number of work shifts, without additional cost to the Postal Service.]

**[STATE:** 1. Responsive Actions: Where CPM schedule monthly progress reports indicate a need or probable need for change in direction, or corrective action, on the part of the Contractor; in order to maintain adequate progress towards substantial completion within Contract Time, including any such determination by Project Director; promptly prepare and submit proposed change(s) of planned procedures, outlining the means and methods by which deficiencies will be corrected.]

**[VA:** Whenever it becomes apparent from the current monthly progress review meeting or the monthly computer-produced calendar-dated schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:

1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.

2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.

3. Reschedule the work in conformance with the specification requirements.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the Contracting Officer for the proposed schedule changes. If such actions are approved, the CPM revisions shall be incorporated by the

Contractor into the arrow diagram before the next update, at no additional cost to the Government.]

**[VOA:** The Contractor shall agree that whenever it becomes apparent from the current Working Schedule that any contract completion date will not be met, because of the Contractor's actions or failure to act, the Contractor shall take some or all of the following actions at no additional cost to the Government:

Increase construction and manufacturing fabricating implementing manpower in such quantities and crafts as will eliminate, in the judgment of the ARCO, the backlog of work.

Increase the number of working hours per shift, shifts per working day or per week, or the amount of construction and/or manufacturing fabricating equipment, or any combination of the foregoing, sufficiently to substantially eliminate, in the judgment of the ARCO, the backlog of work.

Reschedule activities in order to eliminate the backlog of work by performing activities concurrently rather than sequentially. Adequate resources for newly concurrent activities must be certified by the Contractor.]

## **Work Disruptions**

**[NASA:** In addition to downtime restrictions specified in Section III, Article 2, throughout the performance period ongoing operational activities will result in temporary, unscheduled work disruptions. Work disruptions will be initiated by the Government and may occur with as little as one hour notice to the Contractor. Government work disruptions will require the Contractor to temporarily vacate a facility in which a crew is working; however, other work sites will be available for work activities by the disrupted crew.

The Contractor shall allow in its bid for one hundred fifty (150) Government work disruptions. NO additional compensation will be considered for delays associated with these Government work disruptions. Interruptions of one (1) hour or less per shift shall be considered normal work activities and will not constitute a Government work disruption, and will not be compensable or count against the aforementioned 150 Government work disruptions.]

**[NAVY:** Access to the following facilities will be limited due to ongoing operational will be allowed in the facilities except during authorized Work Windows. All work,

final inspection, final testing, punchlist, and turnover shall be completed within the specified work window. The following facilities shall be considered critical facilities and work shall be accomplished strictly in accordance with the following]

**[POST:** The contracting officer reserves the right of partial occupancy or use of facilities, services, and utilities, before final acceptance, without implying completion or acceptance of any part of the project by the Postal Service. Before such occupancy or use, the contracting officer must furnish the contractor an itemized list of work remaining to be performed or corrected. Failure to list an item will not relieve the contractor of the responsibility for complying with the terms of the contract.

b. Costs incurred as a result of such partial occupancy or use of facilities, services, and utilities are subject to equitable adjustment under the Changes clause.]

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## **Appendix B: Project Scheduling Survey**

### **Purpose**

The use of project planning and scheduling techniques is required by Federal agencies as a result of the Federal Acquisition Regulation (FAR). These regulations provide general guidance about how federal agencies are to ensure that taxpayer interests are protected during the construction process. Based on the broad requirements of the FAR, each agency prepares standing operating procedures and regulations that ultimately appear in contract specifications.

Thirty-two agencies have jurisdiction over Federally funded construction projects in the United States. The variation among agency project management practices are a source of confusion and cost for the those who prepare bids for and execute these projects. This survey is being conducted in order to develop some guidelines to assist agencies in developing consistent regulations.

## Instructions

To complete the survey simply "check-off" the minimum requirements from a list of possible project management information that should be gathered for traditional construction processes under a fixed-priced (Part 1) or cost-reimbursement (Part 2) payment basis. You will also be asked to identify requirements that may need to be added for projects containing multiple bid-items (Part 3) and unit costs (Part 4). While there are many permutations of projects, please only consider the typical projects you encounter. The final portion of the survey asks you to indicate those items that you feel need to be identified/clarified when utilizing scheduling software (Part 5).

## Survey of Project Management Practice

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Organization: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_ e-mail: \_\_\_\_\_

Please check the statement that most accurately describes your experience with project planning and scheduling:

- \_\_\_\_\_ I am currently involved in the management of construction projects using computerized project planning and scheduling tools.
- \_\_\_\_\_ Within the past five years, I was involved in the management of construction projects using computerized project planning and scheduling tools.

I have hands-on experience with the following types of projects:

\_\_\_\_\_ Fixed-Price Contracts                      \_\_\_\_\_ Cost-Reimbursable Contracts

**Part 1. Fixed-Price Contracting**

Most projects accomplished by the Federal Government are Fixed-Priced contracts awarded to the lowest responsible bidder. Please identify the dollar value of small and large projects, then check the MINIMUM requirement that should be included in project planning and scheduling.

	Small Projects	Typical Projects	Large Projects
<b>1. Please Enter \$'s</b>	(< \$ _____)	(> \$ _____)	
<b>2. Planning Method:</b>			
a. None	_____	_____	_____
b. Bar Chart	_____	_____	_____
c. Arrow Diagram	_____	_____	_____
d. Precedence Diagram	_____	_____	_____
<b>3. Submission Requirements:</b>			
a. Initial Plan	_____	_____	_____
b. Submitted Monthly	_____	_____	_____
c. Submitted Every 2 weeks	_____	_____	_____
d. Basis for Payment	_____	_____	_____
e. For Evaluation of Changes	_____	_____	_____
f. Updates Inc. Approved Changes	_____	_____	_____
<b>4. Submission Format:</b>			
a. Printed Schedule Reports	_____	_____	_____
b. Network Diagram	_____	_____	_____
c. Narrative of Problem Areas	_____	_____	_____
d. Data Disk	_____	_____	_____
e. Software: _____			
<b>5. Required Contract Staff:</b>			
a. None	_____	_____	_____
b. Qualification Statement	_____	_____	_____
c. Consultant / Specialist	_____	_____	_____
d. On-Site Scheduler	_____	_____	_____
<b>6. Schedule Should Include:</b>			
a. Major Procurement	_____	_____	_____
b. Government Tasks	_____	_____	_____
c. Milestones	_____	_____	_____
d. Other: _____	_____	_____	_____

**7. Activity Coding:**

a. Trade Designation

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

b. Work Area Designation

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

c. Phase of Work Designation

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

d. Other: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**8. Other:**

## Part 2. Cost-Reimbursable Contracting

Some specialized projects require that the risk of the project be shared between the Government and the Contractor. Often these projects are developed using a Cost-Reimbursable basis for payment. Please identify the range of these projects, then check the MINIMUM requirements that should be included in project planning and scheduling Cost-Plus contracts.

### 1. Range of Cost-Plus Projects:

- a. Typical Size of Cost-Plus Projects: \$ \_\_\_\_\_
- b. Range of Project Sized Low: \$ \_\_\_\_\_ High: \$ \_\_\_\_\_

### 2. Planning Method:

- |                  |       |                       |       |
|------------------|-------|-----------------------|-------|
| a. None          | _____ | b. Precedence Diagram | _____ |
| b. Arrow Diagram | _____ | c. Other: _____       | _____ |

### 3. Submission Requirements:

- |                            |       |                                  |       |
|----------------------------|-------|----------------------------------|-------|
| a. Initial Plan            | _____ | d. Basis for Payment             | _____ |
| b. Submitted Monthly       | _____ | e. For Evaluation of Changes     | _____ |
| c. Submitted Every 2 weeks | _____ | f. Updates Inc. Approved Changes | _____ |

### 4. Submission Format:

- |                               |       |                    |       |
|-------------------------------|-------|--------------------|-------|
| a. Printed Schedule Reports   | _____ | d. Data Disk       | _____ |
| b. Network Diagram            | _____ | e. Software: _____ | _____ |
| c. Narrative of Problem Areas | _____ |                    |       |

### 5. Required Contract Staff:

- |                            |       |                          |       |
|----------------------------|-------|--------------------------|-------|
| a. None                    | _____ | c. Consultant/Specialist | _____ |
| b. Qualification Statement | _____ | d. On-Site Scheduler     | _____ |

### 6. Schedule Should Include:

- |                      |       |                 |       |
|----------------------|-------|-----------------|-------|
| a. Major Procurement | _____ | c. Milestones   | _____ |
| b. Government Tasks  | _____ | d. Other: _____ | _____ |

### 7. Activity Coding:

- |                          |       |                              |       |
|--------------------------|-------|------------------------------|-------|
| a. Trade Designation     | _____ | c. Phase of Work Designation | _____ |
| b. Work Area Designation | _____ | d. Other: _____              | _____ |

### 8. Specialized Cost Information:

- |   |                |       |
|---|----------------|-------|
| a. Activities with Cost Codes: _____      | c. Other _____ | _____ |
| b. Integrated w/ Accounting System: _____ |                | _____ |

**9. Resource Information:**

- a. Resource Library: \_\_\_\_\_ c. Other: \_\_\_\_\_  
b. Integrated w/Accounting System: \_\_\_\_\_

**10. Other:**

### Part 3. Projects With Multiple Bid Items

Some projects provide for separate cost elements of a project. One typical way that cost items may be considered in projects are through the use of a bid-item list. Bid-item may appear in either the fixed-price or the Cost-Plus contracts. As a result, identify the **ADDITIONAL** minimum information necessary for contracts that include multiple Bid-Items.

#### 1. Planning Method:

- |                  |       |                       |       |
|------------------|-------|-----------------------|-------|
| a. None          | _____ | b. Precedence Diagram | _____ |
| b. Arrow Diagram | _____ | c. Other: _____       | _____ |

#### 2. Submission Requirements:

- |                            |       |                                  |       |
|----------------------------|-------|----------------------------------|-------|
| a. Initial Plan            | _____ | d. Basis for Payment             | _____ |
| b. Submitted Monthly       | _____ | e. For Evaluation of Changes     | _____ |
| c. Submitted Every 2 weeks | _____ | f. Updates Inc. Approved Changes | _____ |

#### 3. Submission Format:

- |                               |       |                    |       |
|-------------------------------|-------|--------------------|-------|
| a. Printed Schedule Reports   | _____ | d. Data Disk       | _____ |
| b. Network Diagram            | _____ | e. Software: _____ | _____ |
| c. Narrative of Problem Areas | _____ |                    |       |

#### 4. Required Contract Staff:

- |                            |       |                          |       |
|----------------------------|-------|--------------------------|-------|
| a. None                    | _____ | c. Consultant/Specialist | _____ |
| b. Qualification Statement | _____ | d. On-Site Scheduler     | _____ |

#### 6. Schedule Should Include:

- |                      |       |                 |       |
|----------------------|-------|-----------------|-------|
| a. Major Procurement | _____ | c. Milestones   | _____ |
| b. Government Tasks  | _____ | d. Other: _____ | _____ |

#### 7. Activity Coding:

- |                          |       |                              |       |
|--------------------------|-------|------------------------------|-------|
| a. Trade Designation     | _____ | c. Phase of Work Designation | _____ |
| b. Work Area Designation | _____ | d. Other: _____              | _____ |

#### 8. Specialized Cost Information:

- |   |                |
|---|----------------|
| a. Activities with Cost Codes: _____      | c. Other _____ |
| b. Integrated w/ Accounting System: _____ | _____          |

#### 9. Resource Information:

- |  |                 |
|--|-----------------|
| a. Resource Library: _____               | c. Other: _____ |
| b. Integrated w/Accounting System: _____ | _____           |

#### 10. Other:



### Part 4. Projects With Unit-Cost Items

Some projects require that variation in amount of specific project elements be allowed. One typical way that cost items may be considered in projects are through the use of Unit-Cost items. Unit-Cost items may appear in either the fixed-price or the Cost-Plus contracts. As a result, identify the **ADDITIONAL** minimum information necessary for those contracts that include Unit-Cost items.

#### 1. Planning Method:

- |                  |       |                       |       |
|------------------|-------|-----------------------|-------|
| a. None          | _____ | b. Precedence Diagram | _____ |
| b. Arrow Diagram | _____ | c. Other: _____       | _____ |

#### 2. Submission Requirements:

- |                            |       |                                  |       |
|----------------------------|-------|----------------------------------|-------|
| a. Initial Plan            | _____ | d. Basis for Payment             | _____ |
| b. Submitted Monthly       | _____ | e. For Evaluation of Changes     | _____ |
| c. Submitted Every 2 weeks | _____ | f. Updates Inc. Approved Changes | _____ |

#### 3. Submission Format:

- |                               |       |                    |       |
|-------------------------------|-------|--------------------|-------|
| a. Printed Schedule Reports   | _____ | d. Data Disk       | _____ |
| b. Network Diagram            | _____ | e. Software: _____ | _____ |
| c. Narrative of Problem Areas | _____ |                    |       |

#### 4. Required Contract Staff:

- |                            |       |                          |       |
|----------------------------|-------|--------------------------|-------|
| a. None                    | _____ | c. Consultant/Specialist | _____ |
| b. Qualification Statement | _____ | d. On-Site Scheduler     | _____ |

#### 6. Schedule Should Include:

- |                      |       |                 |       |
|----------------------|-------|-----------------|-------|
| a. Major Procurement | _____ | c. Milestones   | _____ |
| b. Government Tasks  | _____ | d. Other: _____ | _____ |

#### 7. Activity Coding:

- |                          |       |                              |       |
|--------------------------|-------|------------------------------|-------|
| a. Trade Designation     | _____ | c. Phase of Work Designation | _____ |
| b. Work Area Designation | _____ | d. Other: _____              | _____ |

#### 8. Specialized Cost Information:

- |                                     |       |                |       |
|-------------------------------------|-------|----------------|-------|
| a. Activities with Cost Codes:      | _____ | c. Other _____ | _____ |
| b. Integrated w/ Accounting System: | _____ |                | _____ |

#### 9. Resource Information:

- |                                    |       |                 |       |
|------------------------------------|-------|-----------------|-------|
| a. Resource Library:               | _____ | c. Other: _____ | _____ |
| b. Integrated w/Accounting System: | _____ |                 | _____ |

#### 10. Other:

**Part 5. Schedule Usage Issues**

As a result of the variety scheduling software, it is often difficult to determine how a specific schedule may have been created. Please indicate which of the following software features should be individually addressed to determine if s schedule has been prepared in a reasonable fashion.

1. Use of Hammock Activities: \_\_\_\_\_
  2. Use of "Plugged" Activity Dates.
    - a. Constraint of Start Date: \_\_\_\_\_
    - b. Constraint of Finish Date: \_\_\_\_\_
    - c. Constraint of Interim Milestones: \_\_\_\_\_
    - d. Other: \_\_\_\_\_
  3. Non-Work Periods.
    - a. Use of Multiple Calendars: \_\_\_\_\_
    - b. Use of Calendars for Extended Non-Work Periods: \_\_\_\_\_
    - c. Other: \_\_\_\_\_
  4. Network Calculations.
    - a. Use of Default Progress Methods: \_\_\_\_\_
    - b. Use % or Remaining Duration: \_\_\_\_\_
    - c. Negative Leads/Lags: \_\_\_\_\_
    - d. Out-of-Sequence Progress: \_\_\_\_\_
    - e. Other: \_\_\_\_\_
  5. Other: \_\_\_\_\_
-

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## Acronyms

ARCO	Area Resident Contracting Officer
BICE	Board on Infrastructure and the Constructed Environment
CETS	Commission on Engineering and Technical Systems
CMC	construction management contractor
CO	contracting officer
COE	Corps of Engineers
CPM	Critical Path Method
CSB	Construction Services Branch, Division of Facility Loans, Bureau of Health Resources Development
DVA	Department of Veterans' Affairs
FAR	Federal Acquisition Regulation
FDA	Food and Drug Administration
FFC	Federal Facilities Council
GFE	government furnished equipment
GSA	General Services Administration
HHS	Department of Health and Human Services
HVAC	heating, ventilating, and air-conditioning
LOB	line-of-balance
NAS	Network Analysis System
NIH	National Institutes of Health
NRC	National Research Council
NTP	notice to proceed
R/E	resident engineer
RMS	resident management system
TIA	time impact analysis
VOA	Voice of America
WBS	work breakdown structure



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